

20 Model Railroad Projects

**by
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With Introduction by A. C. Kalmbach

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Introduction, by A. C. Kalmbach

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To my mother
CECILIA BETNASCH
and to my wife
LUCILLE TAYLOR

I dedicate this book
in appreciation of their
patience and understanding

Introduction

Model Railroader readers are continually amazed that Frank Taylor actually builds all the projects he describes in print. Build them he does, and not only that, but he experiments with various construction methods and works out the best ways for the average amateur to do each portion of the job on hand. Then and only then is he ready to describe the methods to be used. Perhaps that's why his articles are so popular. At any rate, it explains why thousands of model railroad fans, with varying degrees of experience, all have equal success building Taylor-described box cars, signals, trestles, and other items of structures or equipment.

The author of this book used to build models for a hobby—ship models, airplane models, all kinds of models. Then, with the first stirrings of model railroading, he went into O gauge. Later he went into the model business as one of the HO gauge pioneers, sold that business and worked for several years as designer for one of the largest American model railroad firms. He came to *THE MODEL RAILROADER* in 1937, originated the idea of shop-tested projects, and has been with us since, principally as technical advisor and also as art director.

It is our wish that this book be practical to you, that from its pages you build many a successful car or other item for your layout, and that you find the instructions explicit and easy to use. Suggestions are always welcome in our office.

A. C. Kalmbach

Editor, THE MODEL RAILROADER.

Let's Build

This article outlines the use of simple assembly jigs which will save much time when a number of cars are to be built.

BOX CARS



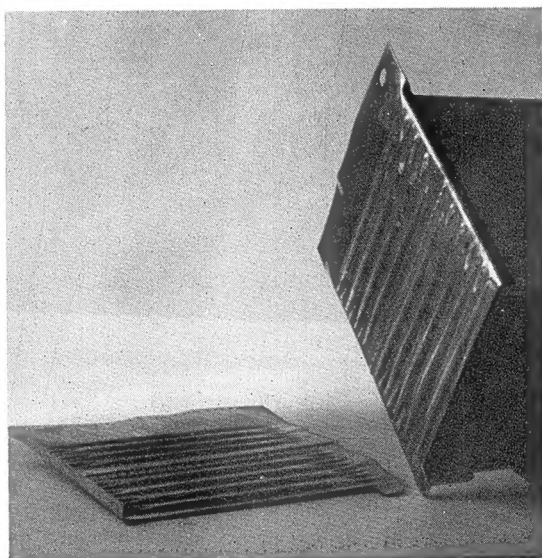
BOX CARS are to be found on almost every railroad in the country. A box car is defined as a car completely enclosed, with doors in the sides and/or ends. The box or body of this car is made of steel or wood and in modeling it the usual practice is to build up this structure of wood. For this purpose thin sheets of plywood can be obtained from your local lumber dealer, along with a quantity of $\frac{1}{8}$ " or $\frac{1}{4}$ " thick solid lumber. The drawings on the next two pages include templates for O, OO and HO gauge cars. Any variations in construction or thickness of materials will be brought to your attention.

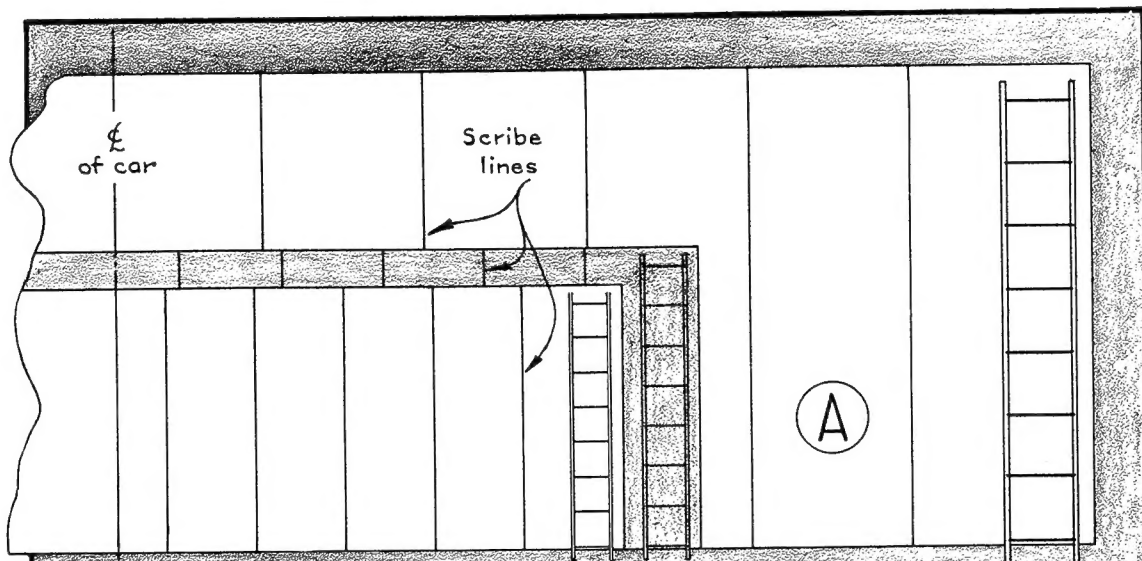
The design and recommendations of the American Association of Railroads (A. A. R.) are not always followed or carried out in every detail by the various railroads in the country. The accompanying photographs show some of the variations which are in existence. The doors and ends of these cars are the most noticeable examples. With perfect propriety you can make the choice of dreadnaught ends or plain ends, corrugated doors or any of the various other types in existence. This also applies to the roof construction and the brake wheel equipment.

The various thicknesses used for the sides are shown in drawing B. As shown, the sides

for the O gauge model are made of $\frac{1}{8}$ " 3-ply veneer, and for the two smaller gauges, $\frac{1}{16}$ " thick solid lumber is used. In the event that you

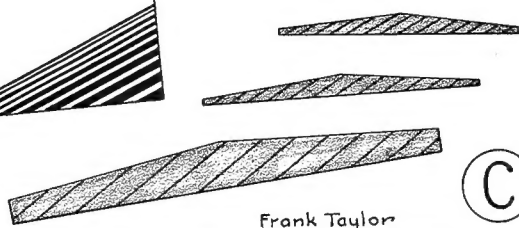
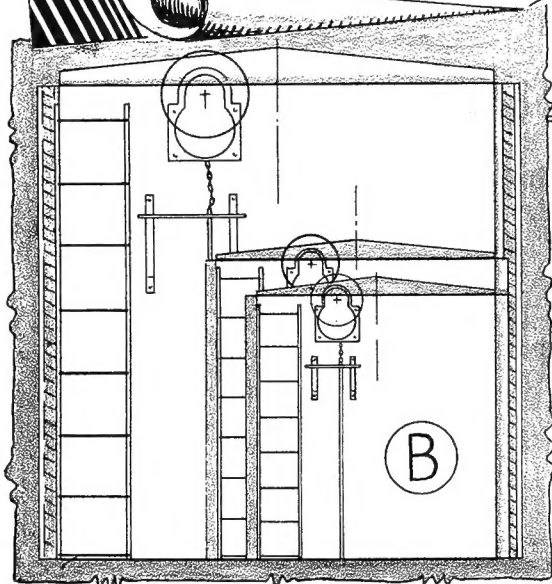
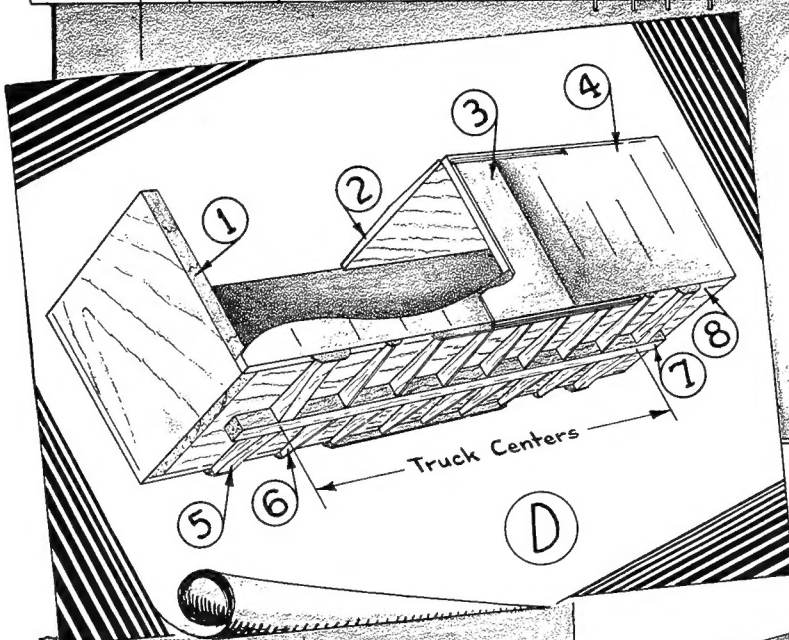
Below: Application of pressed metal end to car body.





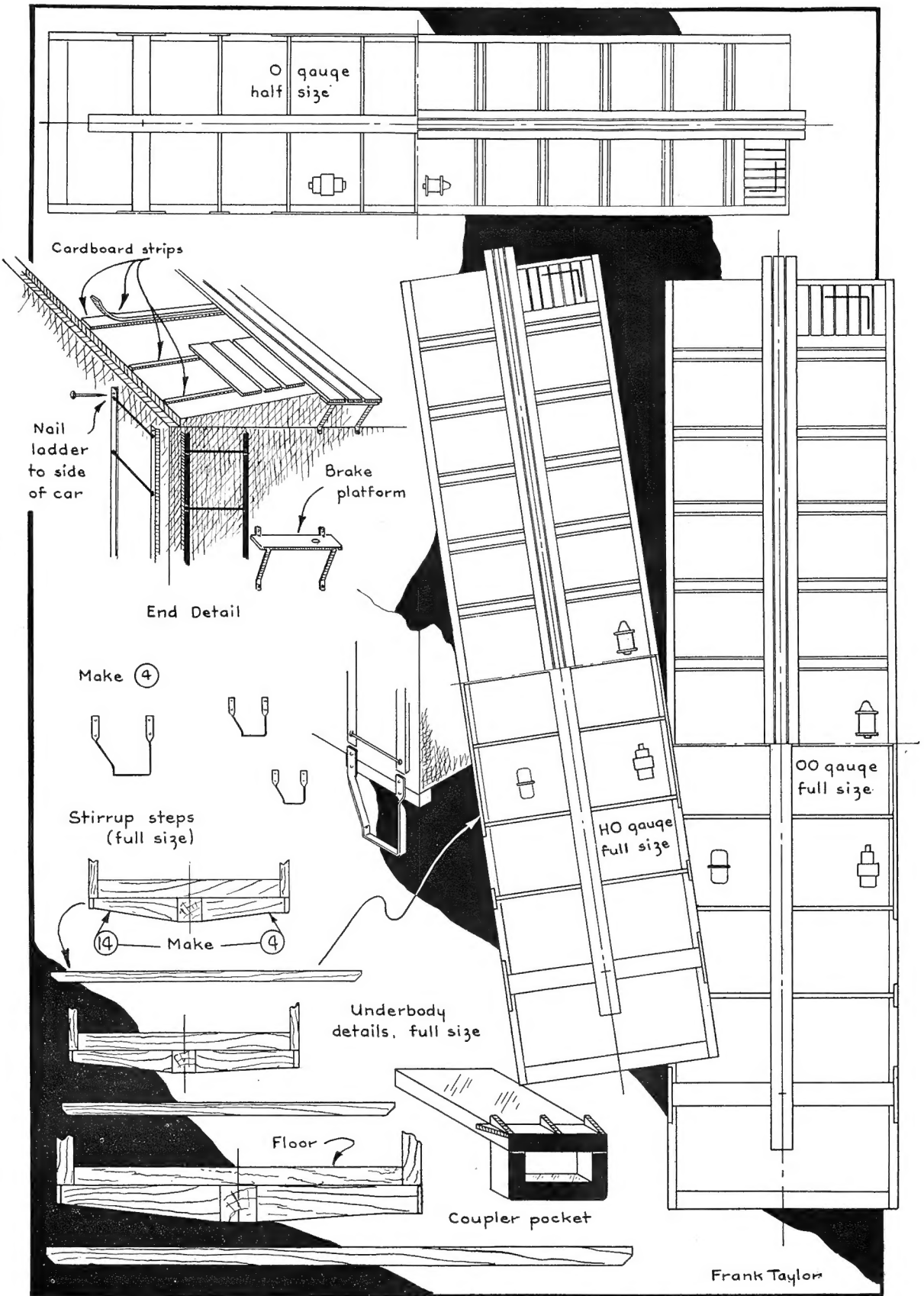
FULL SIZE TEMPLATES

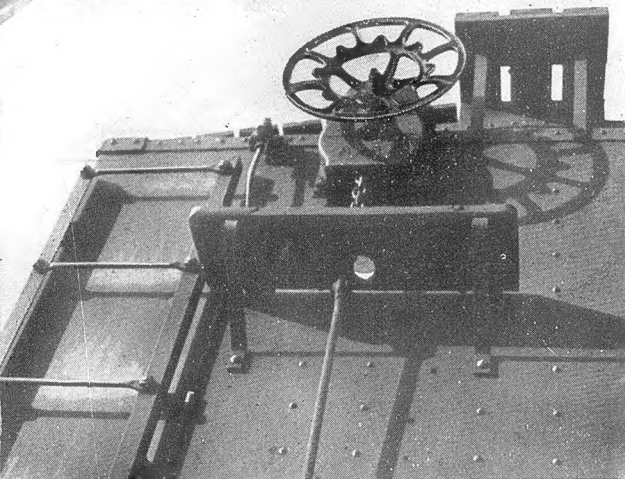
for
HO O OO
MODELS



Frank Taylor

find it difficult to obtain the lumber recommended, it will be possible to substitute lumber of a different thickness by cutting the two end pieces narrower. The point is that after the sides are nailed to the end, the total width should not exceed that shown in the drawings. The floor, ends and roof can also be made of different thickness lumber than that shown in the drawings, provided that you make allowance for these substitutions. If it is intended that a number of these cars shall be assembled, using mass production methods, the various parts should be kept within a certain tolerance. Otherwise using easy-to-assemble jigs will be impractical.





A. A. R. box car with plain end. Notice the chain linking hand brake shaft and Ajax brake wheel housing.

Make up enough parts for the cars you intend to assemble. Make three notched cleats as shown in the first photo at the bottom of this page. Nail these to the top of your work bench in the position shown so that a floor can be slipped into place. The overhanging parts of the cleats should be cut to a size that will allow the wood center sill to be properly located when it is butted up against them. You can glue and nail eight or ten center sills to the floor pieces in a jiffy by using these simply made cleats.

Next, line up a number of the end pieces and proceed to drive in three bank pins in each piece. The pins are located just far enough from the edge of the pieces so that they will pierce the center of the floor. See center photo.

A second jig can be made for assembling the car ends to the floor. A number of cleats are nailed to the bench top so that the assembly is made as if the car were lying on its side. One of the cleats should act as a stop and prevent the floor piece from sliding lengthwise and one or two cleats are nailed down to prevent it from sliding sidewise. Add a couple of cleats, located to hold the end piece in position. It might be well to assemble the ends and floor of one car without jigs and then nail the cleats around the assembly. Refer to the third picture below.

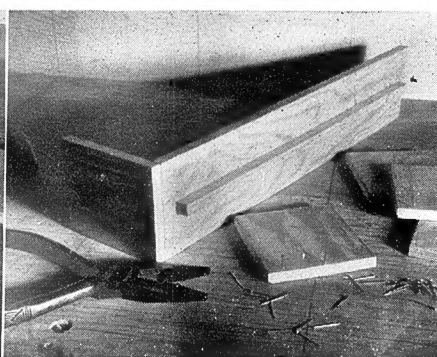
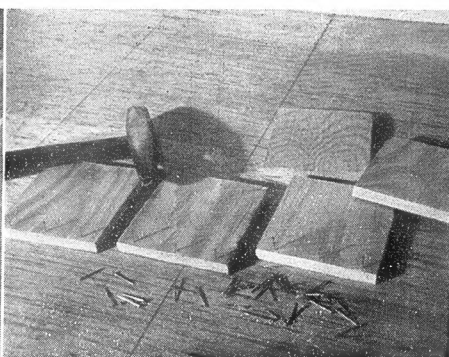
The roof piece is now assembled and it might be well to suggest that the roof can be shaped with a hand plane and sandpapered if a power

saw is not available. See drawing C. The C&O box car pictured on page 1 has a slightly different shaped roof than the one at the top of the next page in that it is recessed on both the sides and the ends on the latter car. These slight variations can be incorporated in your model if you like. Glue and pin the roof to the ends as shown at the bottom of the next page. Check the length of the car at the floor and also at the roof to make positive that some error in cutting has not passed your attention.

The sides are the same width as the end pieces are high, and are glued and pinned in place as shown in the center photograph. The photo on the first page of this chapter shows that the sides of the car are fabricated from sheets of steel. Joints made by fastening of these steel plates can be effected by scribing lines on the sides of the car (drawing A). To make a clear impression, material should be cut so that the grain runs parallel with the scribed lines.

The photo in the lower right hand corner of the opposite page shows the underframe parts called cross members and body bolsters. Refer to *D*. At a first glance there seems to be quite a bit of work involved, but don't be fooled; the pieces of wood that are used to form these parts can be cut to shape with a razor blade and in 15 minutes' cutting time you'll have a surprising number of parts made. The drawing on page 3 should be referred to in locating the various underframe parts. Notice that in gluing the body bolster in place you automatically locate the position of the truck king pin. (See drawing *D*.) The underbody detail shows in full size and you will see that a small valance of wood is glued to the ends of the body bolsters and is made flush with the outside of the car. This also applies to the longer piece that is fastened in the same manner with the center of the piece located directly beneath the center of the door opening. In addition, two more small pieces are fastened to the ends of the remaining cross braces on each side of the car.

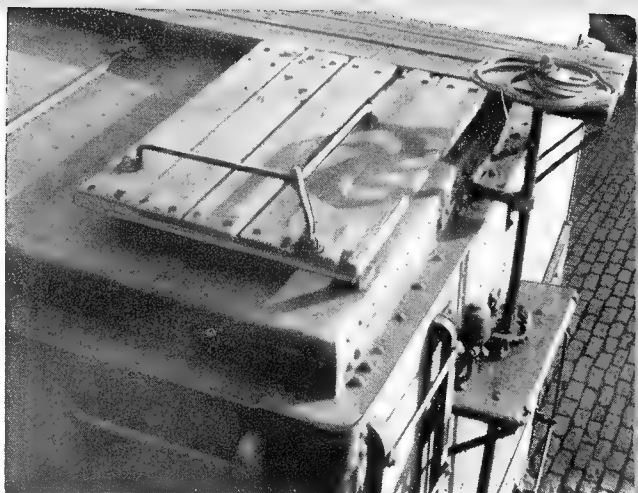
If your cars are to be equipped with pressed metal dreadnaught ends, it is suggested that a



sufficient number of these be ordered from one of the model railroad firms manufacturing these parts. The photograph at the bottom of page 1 shows how these pressed ends are bent up at the sides and how the bent-up end is snapped on to the end of the car in position so that a scribed line can be made around the contour of the roof to indicate where the pressed part should be cut. With the top cut to shape the part is again placed in position on the car and a line scribed along the bottom of the piece, flush with the floor of the car. Before cutting along this line make allowance for the plate that is used to fasten the uncoupling lever. This detail can be seen on the photograph of the prototype; it extends down about 10" below the bottom of the body and is about the same width. Cut the bottom of the end piece to shape, incorporating this tab, which is located at the lower left hand corner, and fasten the end to the car with small bank pins. End details on this car can be attached to this pressed metal piece before it is fastened in place. This will allow you to fasten the various parts in place by soldering the hold-down pins to the end piece, working from the inside, thus saving considerable clean-up time. If, instead of the dreadnaught type end, you make your cars plain ended as shown in the photograph on page 6, the task will be simplified somewhat and the various parts such as ladders, brake platform, and hand holds can be fastened directly to the wood end.

The roof of the car is another item which can be changed in detail and still conform to actual practice. There are a number of companies which manufacture roofs for railroad equipment, and each has patented features. Usually the way the roof plates lock together is the only discernible difference. This feature will cause you to put cardboard strips on the roof as shown on page 2 or leave them off altogether. In case you do not glue on the cardboard strip detail, it will be necessary to glue supports to the roof for the walk to rest on. The advantage of this is that it sets the walk realistically up off the roof.

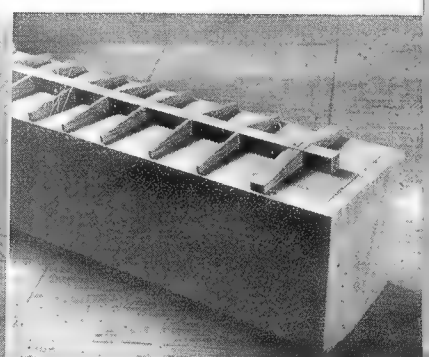
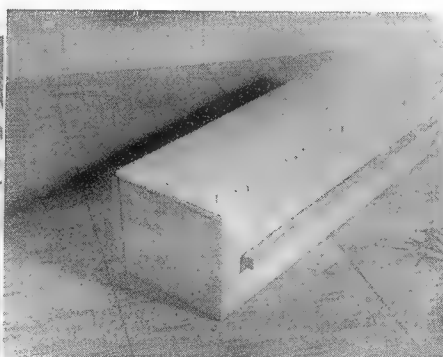
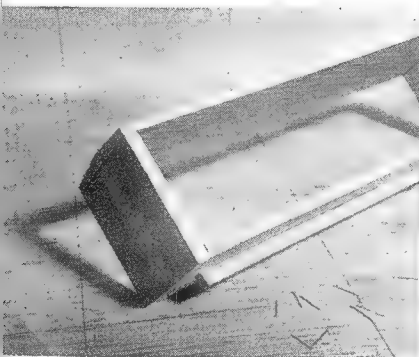
The longitudinal running boards can be made



Another brake wheel arrangement on the same type of car. View shows the roof walks and roof handhold.

up of three separate strips of thin wood, or a single piece scribed lengthwise to represent the three planks can be substituted. In either case pins and glue are used to fasten parts to the support or cardboard strips, as the case may be. Running board end brackets, as shown in the photographs, are put on to support the overhanging section of the running board at each end of the car. Small pieces of brass can be cut, bent and fitted in place or common pins can be driven into the end of the car and bent up into the position shown. A latitudinal running board is prepared for each end of the roof as shown. These running boards rest on either cardboard strips or small square lengths of wood. Refer to the end detail on page 3. The walks can be made up of separate pieces, or one piece of the proper size can be used if it is scribed to represent the number of boards used. Small bank pins can also be used to hold this part permanently to the roof. In using bank pins as fasteners, the heads should be snipped off before the pin is driven flush with the wood.

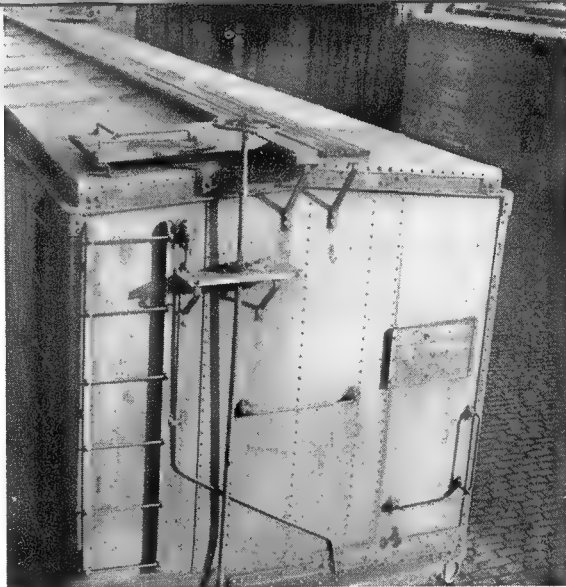
The side doors are located in each car side, midway between the ends. The door is actually 6'-3" wide; in scaling it down, $\frac{1}{16}$ " thick material (either cardboard or wood) is used for the O gauge model and $\frac{1}{32}$ " stock is used for the OO and HO gauge models. Again refer to the photograph on page 1. Notice that a thin strip of cardboard is glued around the edge of the



door and two strips are used to brace the door through the center. A good copy of the actual door will result. The door guide and track can be made by cutting some square sections of wood and gluing them in place. The two door stops that are located at the far end of these tracks are small pieces of wood, glued in place.

The eight-rung ladders, four of which are used on this car, can be obtained from one of the commercial houses or they can be made up by using $\frac{1}{16}$ " square brass and soldering common pins or wire at intervals to form the ladder for the O gauge model. For OO or HO, $\frac{1}{32}$ " square brass should be used, along with thinner wire for the rungs. There are several ways in which the ladders can be fastened to the car side, the most common of which is to nail the ladder in place with bank pins. In this case the heads of the pins are not snipped off. Another way is to locate the ladder on the side of the car with a few pencil lines and then drive in four small pins, after which the ladder is soldered to the heads of these protruding pins. The ladder can then be pried off the side of the car, just enough to give a realistic effect.

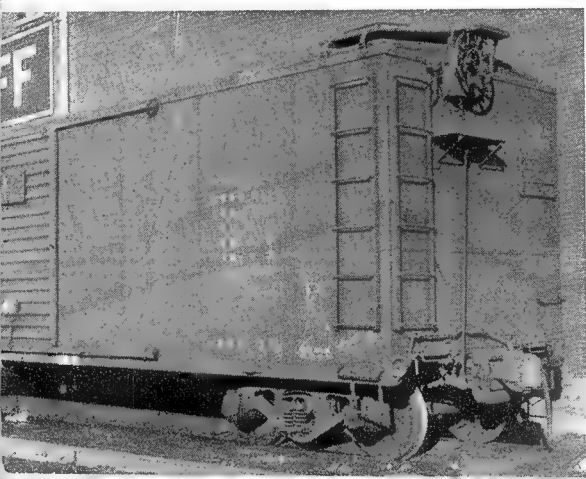
The coupler pocket is made up as shown in the drawing on page 3. The U shaped section at the bottom can be filed from a piece of $\frac{1}{8}$ " thick brass for the O gauge model and $\frac{1}{16}$ " thick brass for the OO and HO models. It is not practical to scale down the coupler pocket because the couplers on the model must have more side swing than the actual equipment. The opening should not be much bigger up and down than the thickness of the coupler shank, and it should be about three times as wide. This proportion will give satisfactory clearance so that the coupler will not bind when going around curves, etc. The face of the pocket, which is shown black in the drawing, is actually about 4" wide. This measurement can be varied anywhere from $\frac{1}{16}$ " on the two smaller models to $\frac{1}{8}$ " on the O gauge model, and still keep it within bounds. The top plate of the pocket, which extends in



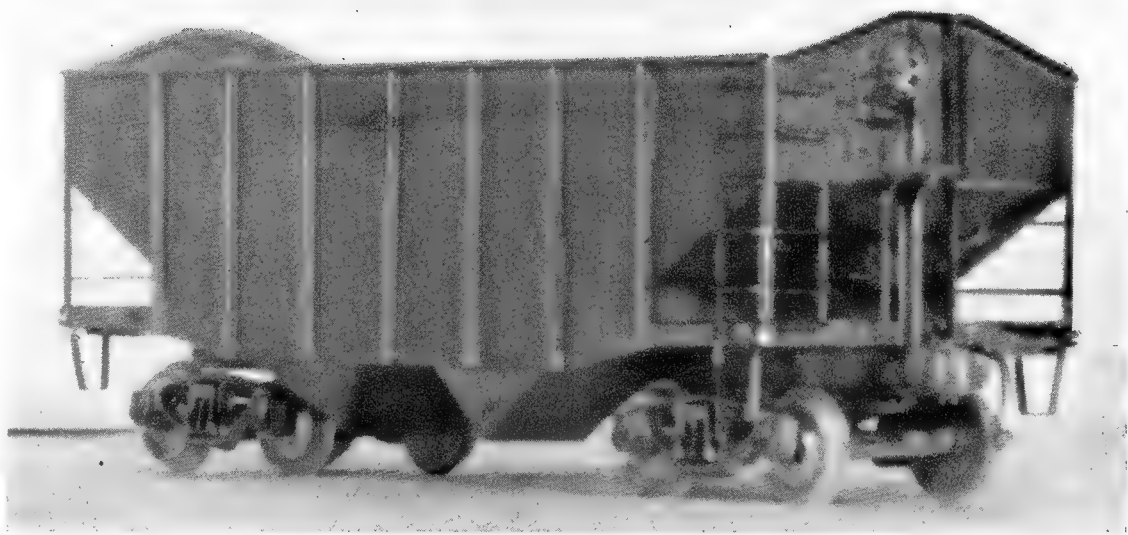
Roof and end details of this car are worthy of note.

under the car, can be drilled for two flat head wood screws for mounting purposes and another hole can be drilled and tapped to allow for coupler mounting. A 2-56 screw is used for the O gauge model and an 0-80 or eye glass screw is used for the OO and HO coupler mountings. The couplers, trucks, brake wheel and air brake equipment can be obtained from your favorite hobby store or manufacturer at prices that discourage the making of these parts in your own shop. The stirrup steps shown in the drawings are bent up from $\frac{1}{4}$ " x $\frac{1}{16}$ " brass stock for the O gauge model, and the same stock can be filed down in width for the smaller sizes. If the Ajax brake and housing are used, refer to the photo on page 4 and to drawing B for details on exact location. The brake staff will be in the same position but extended up above the roof line for the other type of brake wheel. The brake platform can be of wood or metal. The placard board shown in the photograph can be of thin cardboard or metal and one should be fastened to each end of the car and to each door.

The brake equipment consists of a triple valve, air brake cylinder, and tank, and the locations of these are shown in the drawing. The air hose is located just to the right of the coupler pocket and is made up of a piece of wire about twice as thick as the material used for the brake shaft. A blob of solder is formed on the loose end of the wire to represent the fitting shown in the photograph. Details such as coupler lift bar, door hardware, grab irons and roof corner holds are installed in place before painting. The final step is to attach trucks.



This car is equipped with corrugated doors and plain ends. The uncoupling rod is installed for top operation and six-rung ladders are used with a single grab iron below. An unusually large coupler pocket is evident.



The completed model, ready for the paint shop.

HOW TO BUILD HOPPER CARS

Use of Templates and Forming Tools Cuts Down Time in Making Hoppers.

HOPPER cars are recognized as the best vehicles to use in transporting bulk merchandise. The hoppers are incorporated in twos, threes, and fours, depending upon cubic capacity of the car, and as the trend in car construction seems to be for those of larger capacity, some now have as many as six hoppers.

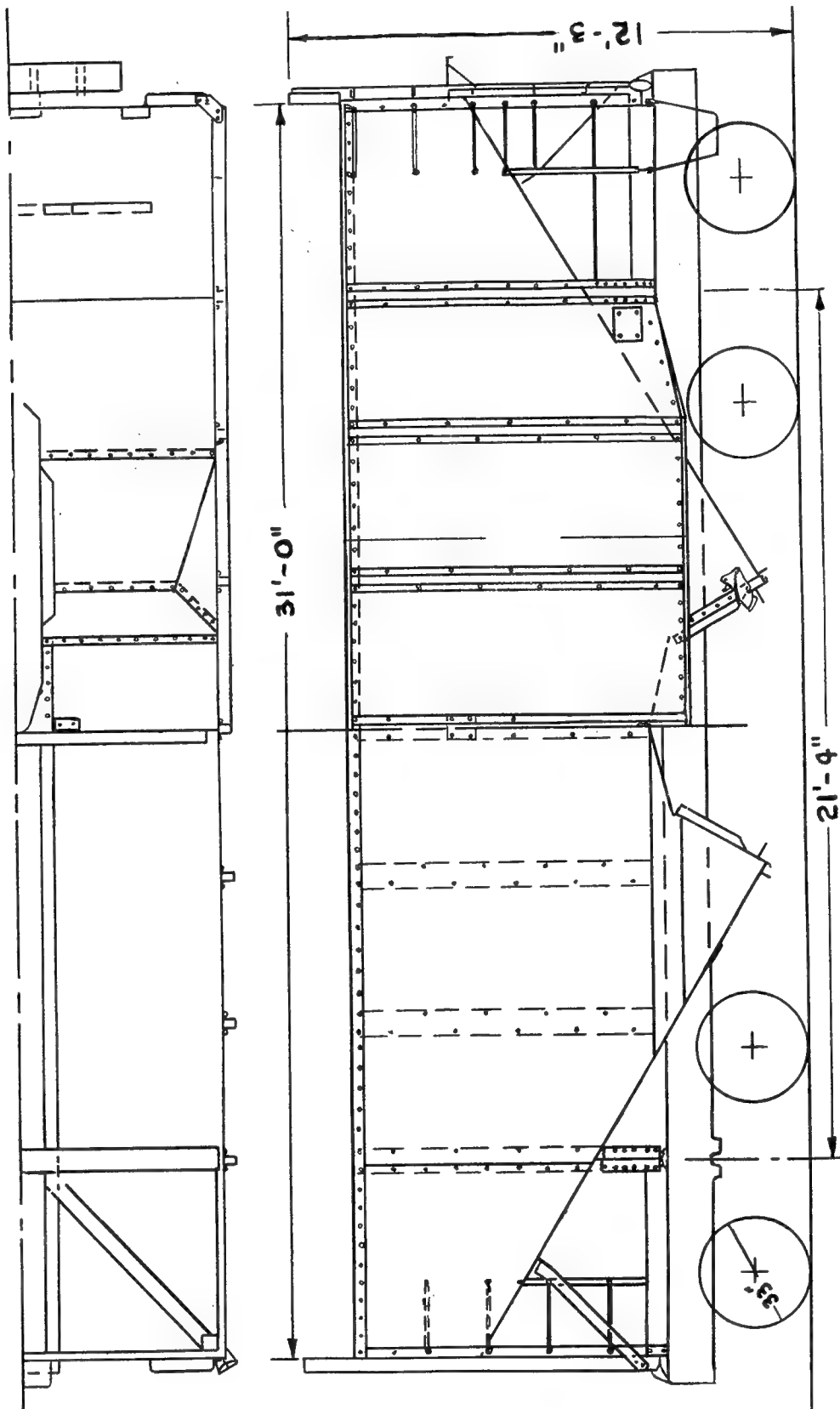
Hopper car construction is somewhat in a class by itself due to the nature of the load. These cars are so designed that the floor slopes on the ends and sides, and the contents can be emptied by gravity. In making the model you need not be too particular about finishing the inside of the car unless it is to be run empty all of the time. Otherwise a piece of wood can be fitted into the car and screened coal can be cemented to this board for an effective load.

A number of these cars can be built up in short order, if a building program is laid out. If you plan to build 10 cars a great saving in time can be effected, due to the duplicating of parts. When several of the same size and shape are to be made, some consideration should be given to the making of a template. Usually, it does not take any longer to lay out and shape the template than it would to make one of the parts. After the template is made, duplicates can be produced rapidly and uniformly. A template was made for the side of the car and with this it

was possible to cut a duplicate side to size from a blank piece of the sheet brass in less than four minutes. So you see, it does not take long for a template to pay for itself in time alone.

We have drawn up full sized templates for the various parts so that O, OO, and HO models can be built with a minimum of reference to the prototype drawings shown on page 8. It is suggested that you make a comparison between the various parts and templates used on the model and their counterparts shown on the prototype drawings. Some differences will be noticed, and if you appreciate the reason for these differences, you will be able to design your own model from prototype drawings with less difficulty in the future.

The various major parts of the hopper car model are listed as A, B, C, and so forth. Notice that part I can be made in several different ways and yet give the same general effect. A punch and die for bending this part can be milled up at a local machine shop. With it you will be able to press out any number of parts with ease, but some consideration should be given to the alternate methods shown in the drawing. Notice that the sides can be bent over to form a flange as shown, or a strip of brass can be soldered to the sides. In the same sketch several ways of making up part C are shown. The first way is to



Norfolk & Western 55-ton hopper car, Class HL. 1/4" scale.

use the conventional part as is offered by the various manufacturers, a pressed metal stamping, or the base can be built up by using a piece of flat ribbon stock (brass or tinplate) and then soldering a piece of square brass section to this as shown. The last method is a little more work, but this shows the possibilities.

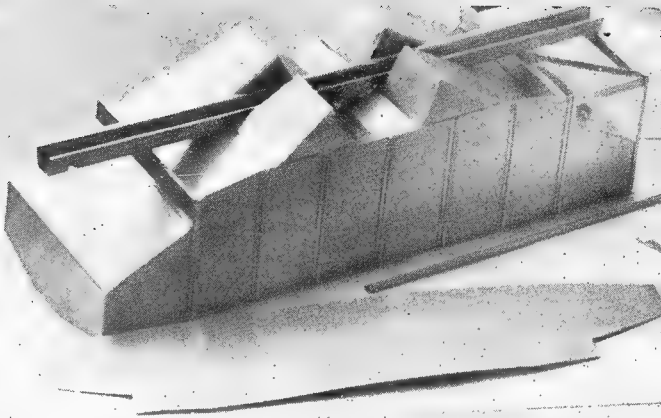
In building a car of this kind it is possible to start on almost any part that takes your fancy. It is suggested that you make sheet metal or fiber templates from the full size drawings shown, and from these lay out and cut the various parts to size.

In the case of template *H*, drill small holes at the points shown just large enough for the rivet forming tool to pass through. This will also apply to template *D*, the sides of the hopper.

Notice that template *H* should have small notches cut in the edges to locate the bend in the sheet. Notches of this type can also be cut in template *D* to locate the braces for the sides. To use these templates effectively it is best to clamp them directly to the stock to be used. Several clamps would be better to prevent any shifting that would otherwise be possible. A sharp scriber is run around the template to lay out the piece proper, and at each notch the scriber is run against the edge of the notch that is parallel to the line to be scratched.

There is usually some slight difference in each model that is built and for this reason it is best to make the hoppers, *E* (in quantity, at least), only when the car has reached an assembly point where they can be tried for a fit.

Part *A* can be made in a punch and die similar to the one described for part *I*. Some difference



As the model hopper car looks during one phase of its construction. Notice the underbody details and the frame bracing at the far end.

in the shape will need to be accounted for. After *A* is formed it can be laid out, locating the various positions of the other parts, *N* and *M*. Notice that *N* is just covered by the contour of the side at that point, and that the total length of *A*, the center beam, is equal to the over all length of the sides.

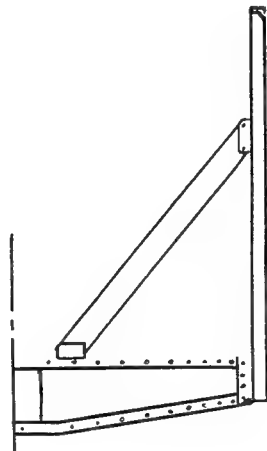
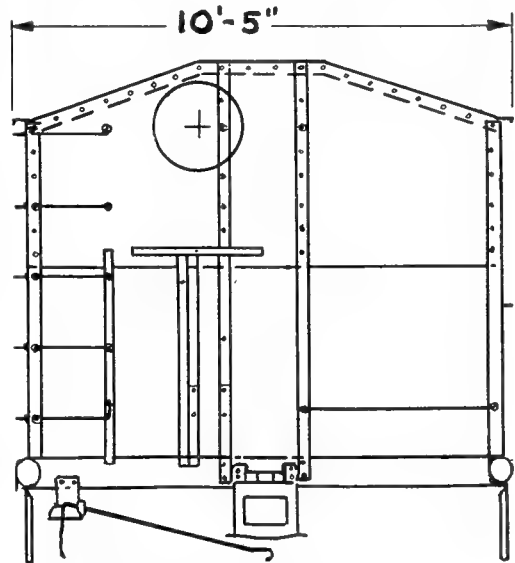
Solder the two *N* parts to *A* in their respective positions. Center each one so that an equal portion can be measured from each side of the center beams. The two parts just referred to can be bent up into channel form as shown, or left flat, as your tastes dictate.

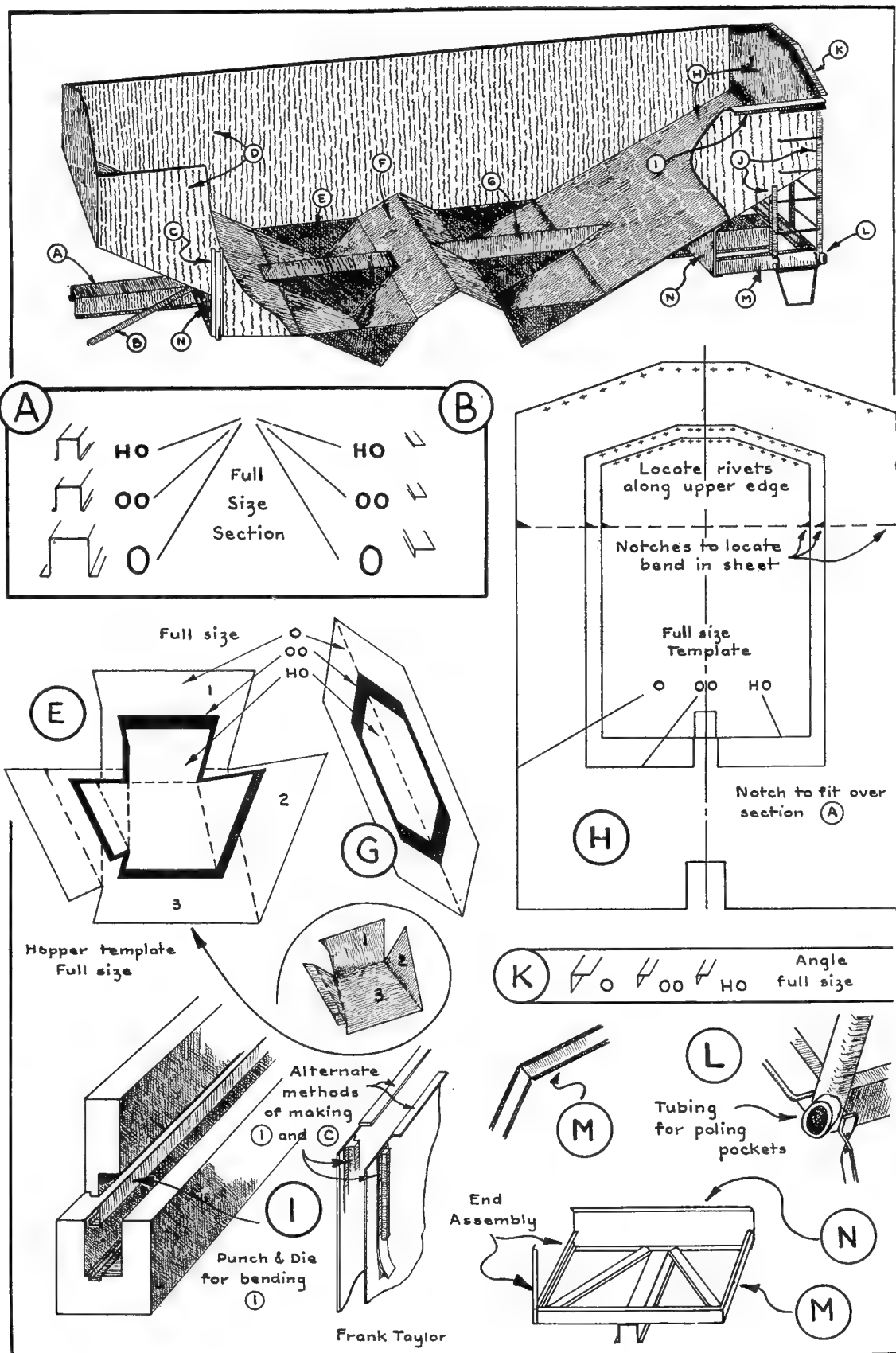
Bend up the two channels referred to as part *M* out of .012" brass sheet stock. The forming can be done over a piece of metal of the desired thickness and afterwards the flanges can be filed down so that the two sides of the channel are in proportion to the bottom. See page 8.

Bend up four angles and solder them in position as shown in the car end assembly drawings, page 10. These are referred to as *B* and can be bent into shape in a vise. Again these parts, both

M and *B*, can be made up from solid stock if so desired.

The sides of the car should be prepared at this time for assembly. The laying out and the cutting of parts such as these from templates has been previously explained. If a drill press is available it is suggested that the rivet forming tools be

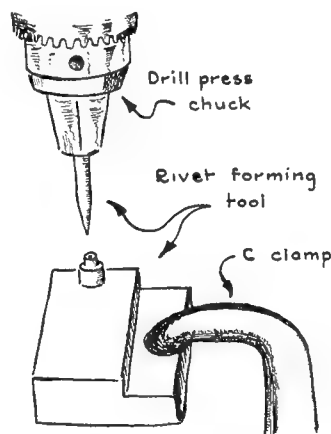




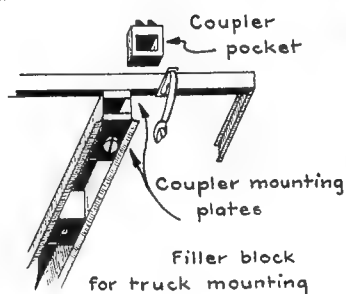
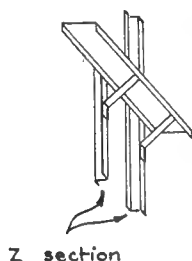
D

O
OO
HO

Actual size pattern for one half of hopper side



Brake platform assembly



55 TON
HOPPER CAR
N & W

made. By referring to the text you will see that the setup is very simple to make. The punch can be made by tapering a piece of drill rod to a point as shown. This piece should be hardened and drawn. The lower half of the tool is made up from a piece of scrap iron into which is pressed a round piece of cold-rolled steel. A step is cut into the foundation piece so as to allow a C clamp to be used in holding it rigidly to the drill press table. A small indentation for receiving the punch is made in the top of the round section of steel. This part could be made from brass to give equally good results. The top or working end of the die should be turned to a smaller diameter so as to allow rivets to be placed closely together when desired.

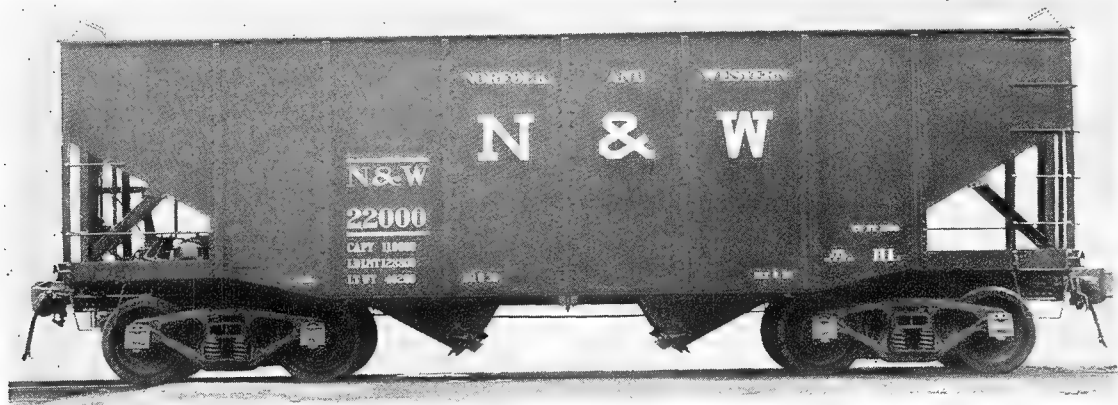
Holes should be drilled in the template at the rivet locations. These should be just large enough to allow the punch to enter them and then complete the operation. In making the rivets with the punch, die, and template, a pro-

cedure is followed which is identical to that used in a structural steel plant. In punching out the holes for the rivets, the position of each one is located on the punch press by locating the centering tip of the punch in the indentation made by the layout man and then the clutch pedal is pressed.

In our case the template is clamped directly to the blank stock and the work is fed against the punch until a hole is located, and then the template and the punch are brought down to bear against the die. The depth gauge on the drill press can be regulated so as to give uniform rivets. The external braces on the sides of the hopper are, of course, fastened in place by soldering them at each end, if the



End view of punch and die for forming part K.



Norfolk & Western 55-ton hopper car, Class HL.

pressed variety is used. This will save some cleaning up of solder, as sufficient solder will flow down in behind the part to hold it firmly in place. A square section of third rail could be used to simulate the bracing. The section used to strengthen the upper edge of the side should now be soldered in place.

The sides should be soldered to plates *N* temporarily. With these in place it will be much easier to fit the ends and slope sheets. These slope sheets, *H*, are made up of .012" brass stock. The bend in this plate should be equal to the angle of the sides at this point. Before bending the end up, however, it will be best to form the rivets which are located along the upper edge as shown. Solder these pieces permanently to *N* and temporarily to the sides. The sides should not be soldered on too strongly until after the hoppers are fitted because it might be advisable to remove the sides to facilitate the assembly of the hopper and parts *G* and *F*.

With the exception of the stirrup steps, hand rails, coupler mounting plates, coupler pockets, and round wire, all of the parts of the hopper car are made up from the same thickness sheet stock. Although .012" brass sheet stock was mentioned, tin plated sheet iron of the same thickness can be used with equal facility.

Make up a template for the hopper, *E*, from the drawing and then make up the desired number of hoppers from this template and cut them to shape. Due to the shape of the hopper, two rights and two lefts must needs be made for each car. These can be made from the same template by simply bending those for the right side of the car in one direction and for the opposite side in the other direction. The dotted lines show where the bends should be made. Do not try to bend up the tabs with fingers. Instead, do the bending in a vise. Tack each hopper in

place and ascertain whether any change in your template needs to be made. If O. K., solder the hopper permanently to the center channel and to the slope sheet. Notice that the slope sheets overlap the hopper at this juncture.

Plate *F*, as shown in the perspective, should be fitted for your particular model and is necessitated by the discrepancies that may have crept into the assembly of the hopper. The piece should be cut as wide as the slope sheets and is bent to look much like the roof of a box car except that the angle is greater. Solder the parts in place as shown. Two pieces shaped to form *G* are now soldered in place. Some filing or change of shape from the template might be necessary to make the parts fit.

A close appraisal will show that some of these last mentioned parts can be assembled and worked on with more dexterity if the sides are removed. Perhaps the removal of only one side will be sufficient.

Bend the angles *J* and solder them to the body. These angles will support the grab irons, which can be laid out at this time. Drill the holes and after inserting the grabs solder them from the inside wherever possible.

To install grab irons neatly, a filler block or a piece of cardboard can be placed between the grab iron and the side of the car to insure equal spacing for each of them.

The poling pockets are fashioned out of small tubing. The first step is to file a V into one end of the tubing so that it will fit the corner of the car, and after a nice fit is obtained the tubing can be cut off approximately to the length desired. Solder the formed pieces of tubing in place as shown and also fill up the center of the tubing with solder. Next, file off the attached tubing to the proper length and then twirl a drill with the fingers to form a dish shaped poling pocket.

The coupler pockets are filed out of a piece of brass of the proper thickness. This will vary depending upon the size of the model, and can be scaled directly from the prototype drawing. The strengthening ribs to be found on the top of the coupler pocket are filed to shape from the same piece of metal. This is easy to do and saves the tricky soldering job of trying to fasten these ribs as separate pieces to the coupler pocket. Do not solder the coupler pocket to the center beam until after the coupler mounting plates are soldered in place. The coupler mounting plates are installed for two reasons, namely, stock of sufficient thickness is made available for tapping the coupler mounting screw hole, and they regulate the height of the coupler from the top of the running rails. This coupler height can be determined by setting the car on a pair of trucks and measuring up from the top of the rails to locate the center of the coupler. This dimension is 10 mm. for HO, 11.5 mm. for OO, and $\frac{3}{4}$ " for O gauge. Knowing what the thickness of the coupler shank is, you can easily determine what thickness stock to use for the mounting plates. In making these calculations one determining factor should not be overlooked, and that is the distance between the top of the rail and the bottom of the side of the car.

Variations in the location of the truck bolster of the different manufacturers' trucks will cause the car to sit too high or too low, so check this measurement, which is a scale 2'-9" between the top of the rail and the bottom of the car side. It might be necessary for you to solder a washer to the bolster to bring the car up to the proper height, or file the bolster down for the opposite effect. Notice the square brass insert that is soldered inside the center beam and forms the means of attaching the truck to the car. For two-rail control it is suggested that the truck be insulated from the car although this is not absolutely necessary if the insulated wheels are always kept on the same side.

Bend up the Z section to be used on the end of the car. Pieces of square third rail material can be substituted if the bending job seems too difficult or time consuming. These pieces are soldered to both the ends and to channel M. The car end with the brake platform has an additional Z bar soldered in place. This is shown directly beneath the brake wheel, and helps support the brake platform. The brake platform is bent up into channel form from the usual sheet stock, and soldered in the place designated.

The Ajax brake wheel housing is pinned to the car body. Drill four holes for the pins to

match the ones in the housing, and after inserting the pins through the housing and the body, solder them to the inside of the car. The brake wheel is fastened in place in a similar manner. By all means, avoid using brake wheels that are cast from lead base materials. A misdirected touch of the soldering iron transforms the brake wheel into something undesirable in a hurry. If you find it difficult to obtain an Ajax brake wheel and housing these can be made up, as is described in a later chapter entitled "Wagon Top Box Car."

The air hose is made of a round piece of brass wire, bent to approximately the shape shown. A blob of solder is put on the lower end, and this is filed to represent the fittings. The other end of the hose is soldered to a bracket on the car. The bracket is a small piece of sheet brass. Refer to the drawing.

The bottom side of the slope sheet is braced as shown. Actually an angle is fitted laterally to the bottom of the sheet as shown on the prototype drawing, and two angles are fastened near the center of this with their opposite ends fastened to the Z bars. Although there are any number of hopper cars on the road without this type of bracing, installing it is worth the effort because this detail adds that distinctive something or other to the model.

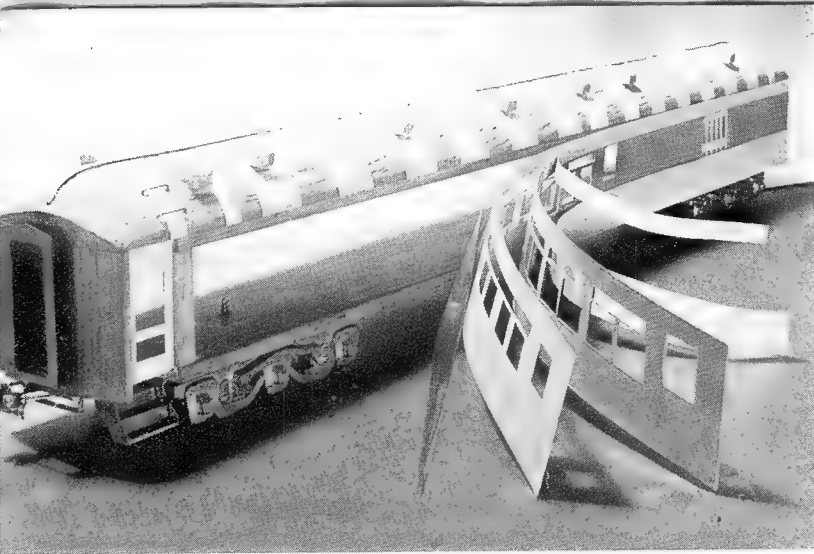
For the O gauge model, the stirrup steps are made of $\frac{1}{4}$ " x $\frac{1}{16}$ " stock. The smaller models should use stock proportionate in size. The ends of each strip are given a quarter turn to follow the customary style. Spread the step slightly for the taper effect shown in the photograph.

There are a few handrails required by the I.C.C. that remain to be mounted. These are soldered to the body in the usual way and the solder cleaned off. Refer to the drawing for the exact location.

One bit of actual construction remains to be handled, and that is the soldering of the inside center braces. These can be plain pieces of flat brass stock soldered to the sides and near the center of the car bottom. The drawing of the prototype shows this detail.

If you wish to add further detail, several opportunities are left open for more tongue biting exercises. The hopper has several angles and fittings that can be added along with operating doors if you have the inclination.

Wash the car in a strong cleaning fluid before painting to remove grease and other paint defying materials. The car should be painted black and numbered in the 22,000 to 22,599 series, if lettered for Norfolk & Western.



Most of the methods and kinks used in making this combine are also applicable to other passenger train equipment. The photo shows the model in the process of construction.

An Easy-to-Make PASSENGER-BAGGAGE CAR

THE art of building passenger cars with cardboard sides is virtually unknown to many model railroaders. At one time the method was used rather extensively, perhaps due to the lack of car side variety. The material is easy to cut, can be obtained without much trouble, and only two thicknesses are used in making the car illustrated above.

The roof for the O gauge model is shaped from a block $\frac{3}{4}$ " x $2\frac{1}{2}$ " by roughly 2 ft. long.

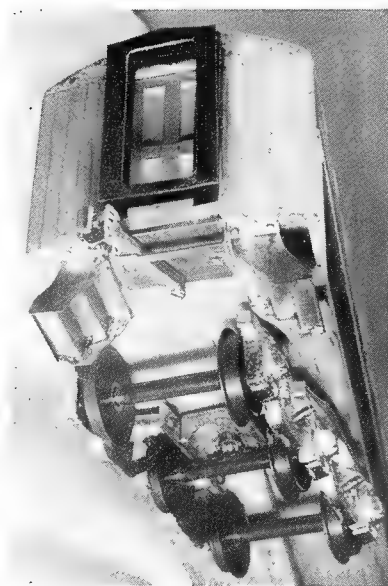
A straight grained piece of clear sugar pine should be obtained. Lay out the contour of the roof on each end of this piece and then plane the roof to shape. Finish the job with rough and then fine sandpaper. Refer to Fig. 7 and illustration C for the full-size roof template. Also on page 18 you will notice that photographs show a method of using a cardboard template to check the roof outline. Next make two ends for the car as shown in Fig. 1. This drawing is also full size, for your convenience in laying out the parts. Shape the ends, using the layout methods described in making the roof. The beveled surfaces can be shaped with a file or plane and the $\frac{1}{8}$ " deep cut which will be used to outline the door can be dug out with a chisel. Two notches are also filed or chiseled in the piece to form a rabbet for the car sides. The man who is fortunate enough to own a circular

saw will need no instructions as to how to cut out the ends on his machine. The two end pieces are each cut $1\frac{1}{8}$ " long.

A floor piece, either $\frac{3}{16}$ " or $\frac{1}{4}$ " thick and as long and wide as the roof piece, will be needed. This width and length is somewhat oversize and can be brought to exact size after the thickness of the car side material is determined.

Cut two long cleats and two short ones to fit under the roof as shown in Fig. 2. Also prepare six posts $\frac{1}{4}$ " square to fit between the floor and the cleats. The posts are used as supports at the door openings and are useful when attaching the grab irons.

Before the roof cleats can be nailed in place it will be necessary to determine the thickness of the car's sides, sash and window material. The total of these should equal the recess formed by the cleats. Refer to Fig. 6. The car side material is about .020" thick; the sash material can be about half as thick, and the window material

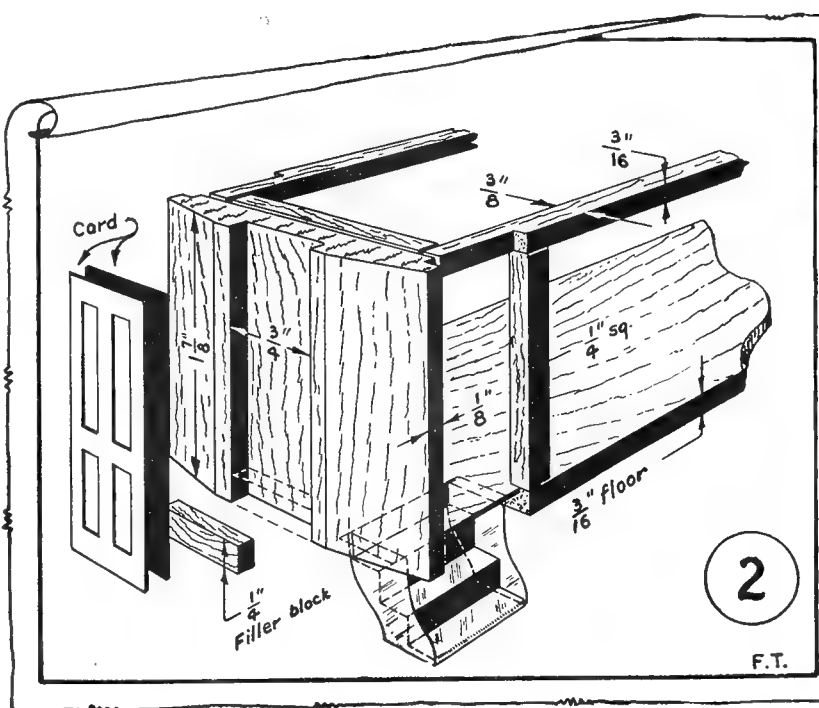
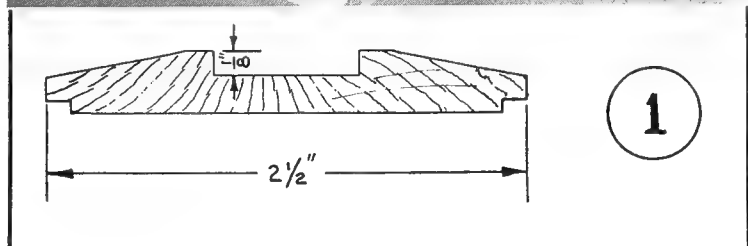


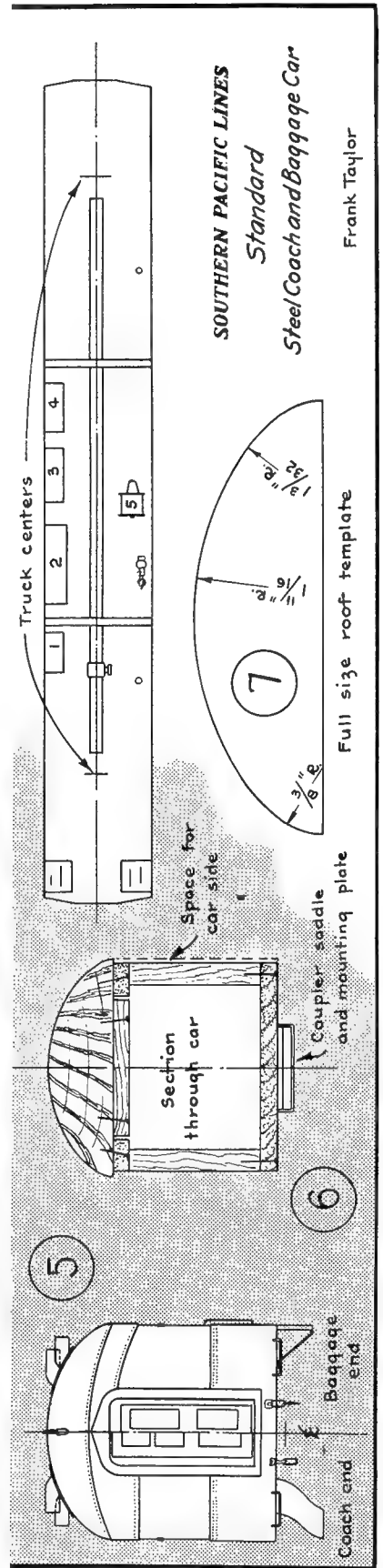
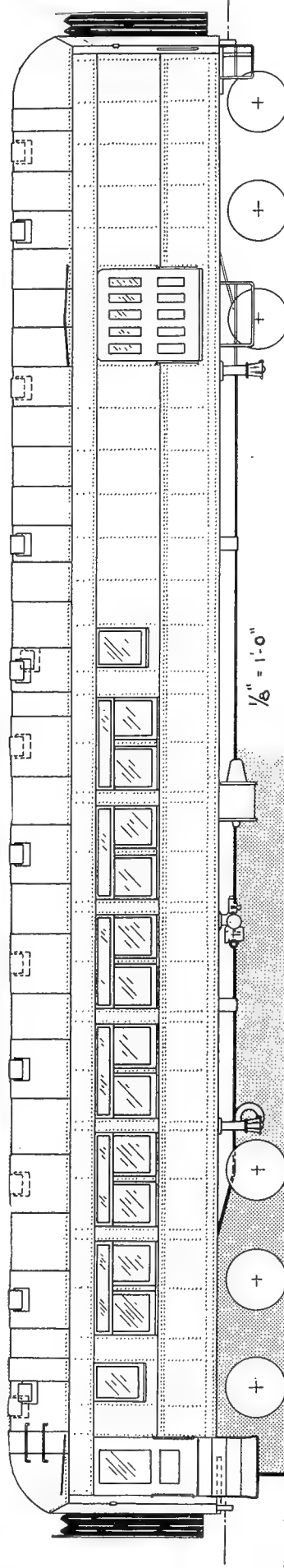
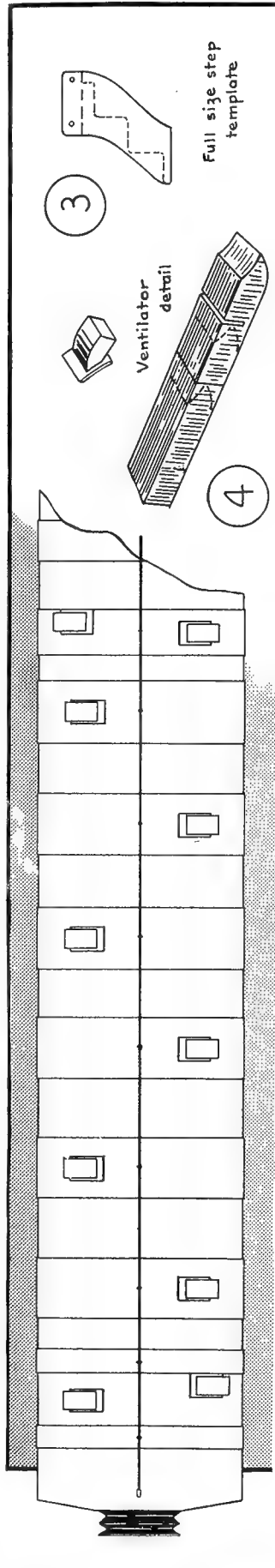
A Left: View shows the step and coupler mounting assembly. Also notice the end door and diaphragm arrangement.

will vary somewhat depending upon your source of supply. Use model airplane cement and bank pins to fasten the cleats to the roof. See illustration D. Make proper allowance for the end pieces of the car and in locating these assure yourself that the car is of the correct length. The drawing on page 16, showing the side view of the car, is half size. For this reason, multiply all dimensions by two. Next fasten the ends and floor in place. See illustration E. Incidentally, the floor width should coincide with the over all width of the long cleats previously nailed to the underside of the roof. Naturally the car should be the same width at the floor level as it is at the top of the car. Do not notch the various door openings until after the sides have been cut. This suggestion also applies to the installation of the $\frac{1}{4}$ " corner posts used at the door openings.

Before the glue actually sets up, check the structure with a try-square and make whatever adjustments are necessary.

Lay out the car sides with pencil and try-square. First draw two lines to locate the letterboard above the windows and the panel below them. Next, lay out the various windows on one car side. When this is finished, transfer these markings to the other side, butting the letterboard edge of one against the same edge of the other and using the try-square again to advantage. Cut the window openings next. A flat steel rule is held firmly in place with one hand, while the razor is guided against it in order to obtain a clean cut. Cut the bottom of the window opening first, then the top and the sides. Do not try to cut through the cardboard in one stroke; use at least two for accuracy. Chances are that the corners will pre-







Three-quarters view of the prototype. The layout of the lettering and additional details can be determined from this.

vent the blank from falling out; in this case go over that part of the cut once more. If you force the piece out, the window opening will have a ragged appearance.

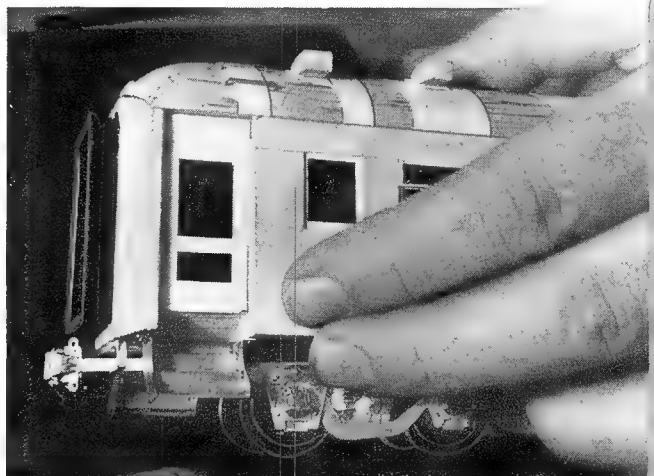
In order to form the round corners at the top of the baggage doors a little kink is resorted to. Refer to picture J, which illustrates the methods used. A $\frac{1}{4}$ " hole is drilled in a piece of brass stock and an ordinary piece of $\frac{1}{4}$ " diameter round rod is used for a punch. The die is lined up with the punch and clamped in place to the table of the drill press. This kink will not be of much use to the fellow who does not have a drill press and he will have to resort to cutting the round corner by hand. Cut the sides to exact length; then place them in position on the car body, after which the exact position of the door openings can be located on the floor and roof cleats. Notches to recess the doors can now be cut into the wood parts.

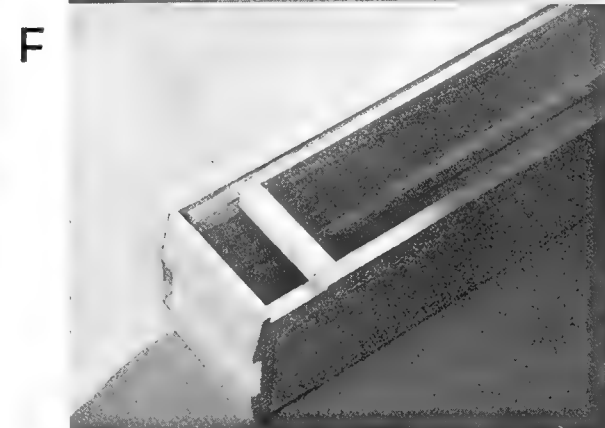
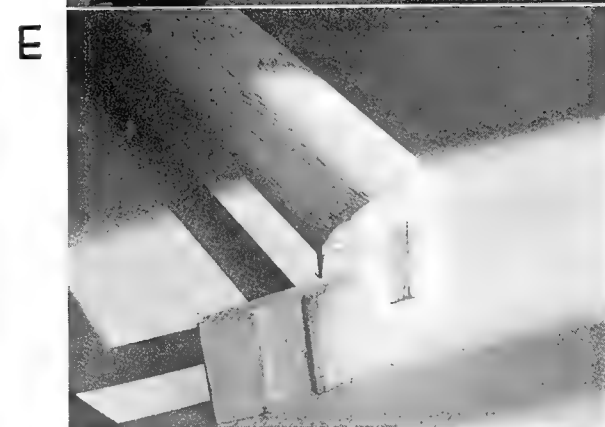
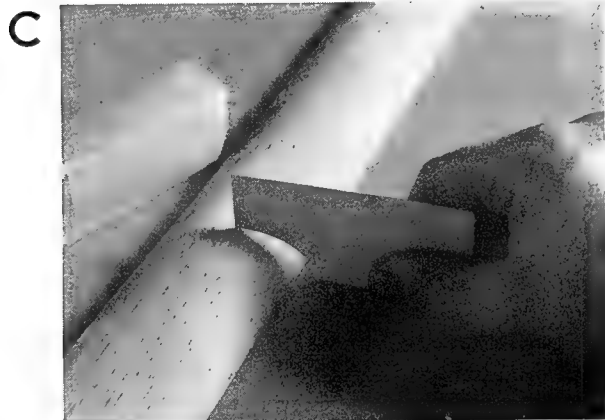
The sash material is prepared by cutting two pieces to the same width as the car sides. Next lay a car side on one of the sash pieces; line up the edges perfectly and hold them in this position with scotch tape or paper clips. Using a sharp hard pencil, draw the window arrangement on the sash material, using the car side openings as a guide. Also draw lines on the sash material to designate where the car sides end. The side and sash pieces can now be taken apart, which will allow you to lay out and cut the sash openings. A glance at the drawings will show that the sash opening is somewhat smaller than the window opening. The thickness of the sash can be determined by doubling the dimensions on the drawing and transferring these to the sash material. Use lines of the window openings on the sash material to measure from. These smaller openings are cut in the sash material in the same manner as that used for cutting the openings in the sides. The baggage door panels and windows are laid out and cut to shape as shown. Also make two vestibule doors and cement them in place to the car body. Next, a piece of cardboard can be cemented to the inside surfaces of these doors in order to cover up the

lower openings and thus simulate the panels that are to be found on the prototype. The doors are all recessed almost $\frac{1}{8}$ ", a detail that was taken care of when the notches were cut or filed in the floor and roof cleats. The corner posts at the openings will form the necessary side frames for each door and also offer support for the card side assembly. See illustration F.

Fix a piece of cardboard in the end of the car as shown in illustration G and then locate a center line on the cardboard. Set your compass and scribe the roof lines as shown. The radius should be $2\frac{1}{2}$ ". A coarse file or knife can be used to take off the excess material and a piece of sandpaper wrapped around a piece of wood can be used to finish the roof ends to the contour shown in the various photographs and drawings. Every precaution should be taken to eliminate scratches in the roof, as they will show up a good deal more after the paint is applied. Cardboard strips are cemented to the roof in the positions shown. Lay out the lines on the roof to locate these strips, which, incidentally, can be cut from a good grade of writing paper and cemented in place. See illustration H. Next, locate the various ventilators and make up enough of these to equip the car. The ventilators are fashioned from a stick of wood $\frac{3}{16}$ " x $\frac{1}{4}$ ". Referring to Fig. 4, notice that the curved portions of the ventilator are filed in the stick first and then it is cut up into lengths. To begin, make a template

B Below: The various details are brought out in this photo. The recessed door is made as shown.





and, with this, lay out the ventilators on the wood stock to insure exact duplication. Notice that an oblong piece of paper is glued to the roof beneath each ventilator for added detail. The grab irons and rain gutters are about the only other roof details and these can be made from thin wire bent to shape and the ends pushed into the roof. See illustration I.

A full-size step template is shown in Fig. 3. Four of these parts will be required, two for each step. Lay out and cut one accurately to shape. Then solder three blank pieces to it and file and cut the blanks to the shape of the finished piece. Bend each piece on the dotted line, making two left hand pieces and two right hand pieces in doing so. Next, drill two holes in each flange or bent section for mounting purposes. The treads and risers of the steps are bent up from a single piece of .012" thick brass stock cut $\frac{3}{4}$ " wide. In this particular case the steps and risers are of equal dimensions. Refer to the dotted lines of step template in Fig. 3. To complete the step, solder these various parts together. Before attaching them, file the floor to a beveled edge directly below the vestibule doors, the reason being that the doors do not extend down far enough to cover the floor piece at this point. Next, fasten the steps in place and lay out the position of the coupler saddle and mounting plate. Refer to Fig. 6 and photographs A and B. The size of the mounting plate is not critical except that it should be about $\frac{1}{16}$ " thick in order to locate the center of the coupler in proper relation to the body of the car. The drawing shows the plate $\frac{3}{4}$ " long and 1" wide. The coupler saddle can be bent up from wire or flat stock and its function is to support the coupler shank. Allow as much room as possible for the couplers to swing. In other words, do not cut off the shank of the coupler but fasten it to the plate at the very end of the shank, as shown.

The air brake cylinders, triple valve, steam traps and generators are shown in the drawing. These can be purchased so cheaply it is hardly worth while to make them. This can also be said of the diaphragm, steps, trucks and couplers. Your choice will govern you in this matter. The drawing shows dimensions and locations of these various parts.

The floor plan, drawn to $\frac{1}{16}$ " scale, is located directly above Fig. 7 and from it the truck centers can also be located along with the center sill and braces. This drawing was made in reverse, as if you were looking down upon the actual floor and could see through it. No. 1 is a tool box; No. 2, a main reservoir tank made from a piece of doweling. No. 3 is a battery box

and No. 4 an auxiliary tank made from a piece of doweling. The center sill and braces are simulated by using a strip of wood to the sizes drawn. Bevel each end of the center sill and taper the cross braces to a feather edge where they meet the car sides. For additional detail a piece of thin cardboard slightly wider than the center sill can be glued in place to form a structural appearance. The generator is then fastened to the center sill.

The photograph at the top of page 14 also shows two strips that are glued to the car sides. The narrow one is cut the same width as the letterboard and is glued in place. The wider piece below the windows is cut and fitted in the same manner. Trim away the material at the baggage door openings. To achieve the proper effect, these strips should also be cemented to the ends of the car as shown in Fig. 5.

The end doors are made up from cardboard and glued in place. Notice that the door for each end is different. A straight piece of wire is also fastened to the roof for almost its full length. See drawings and illustration I. Small staples for fastening can be bent up from common pins. The stirrup steps beneath the baggage door, etc., are bent from $\frac{1}{64}'' \times \frac{1}{16}''$ brass stock and fastened in place as shown. You might find it necessary to relocate these steps because, as is, they might interfere with the swinging of the trucks. Trucks of one manufacture might cause more step adjustment than another brand even though each is a six-wheel Commonwealth truck. To fit and try is the answer.

The installation of the trucks and hardware practically completes the car. The trucks are fastened to the wood floor with round head wood screws and the grab irons are bent up and pressed in place as shown. After the trucks are installed place the car on a section of track and check the coupler height. The distance, measuring from the top of the rail to the center of the coupler, should be $\frac{3}{4}''$ according to N. M. R. A. standards.

Two air hoses are bent and installed on the right side of the coupler at each end, along with a steam hose which is placed on the left side of each coupler. A blob of solder is formed on the end of each hose to represent the fitting used on the actual car.

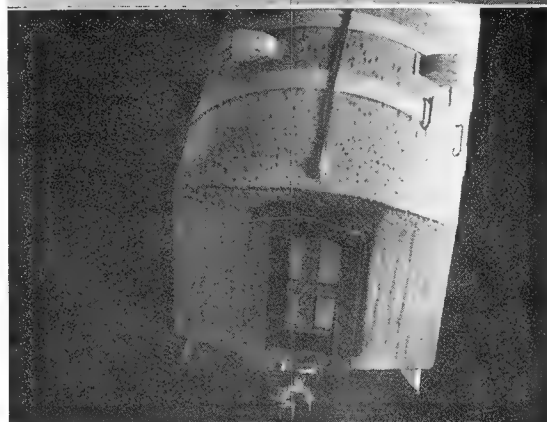
After the car is painted, detailed rivets can be made by locating each one with pen and india ink. What you actually see when looking at a car is the shadow or different light tones caused by the shape of the rivet heads. Putting on this shadow in the above manner carries out the idea rather well.



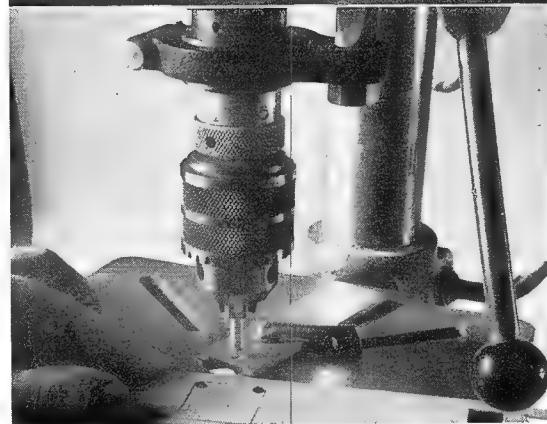
G



H



I



J

BUILD A COMPOSITE GONDOLA

Loaded cars make model railroading seem realistic.

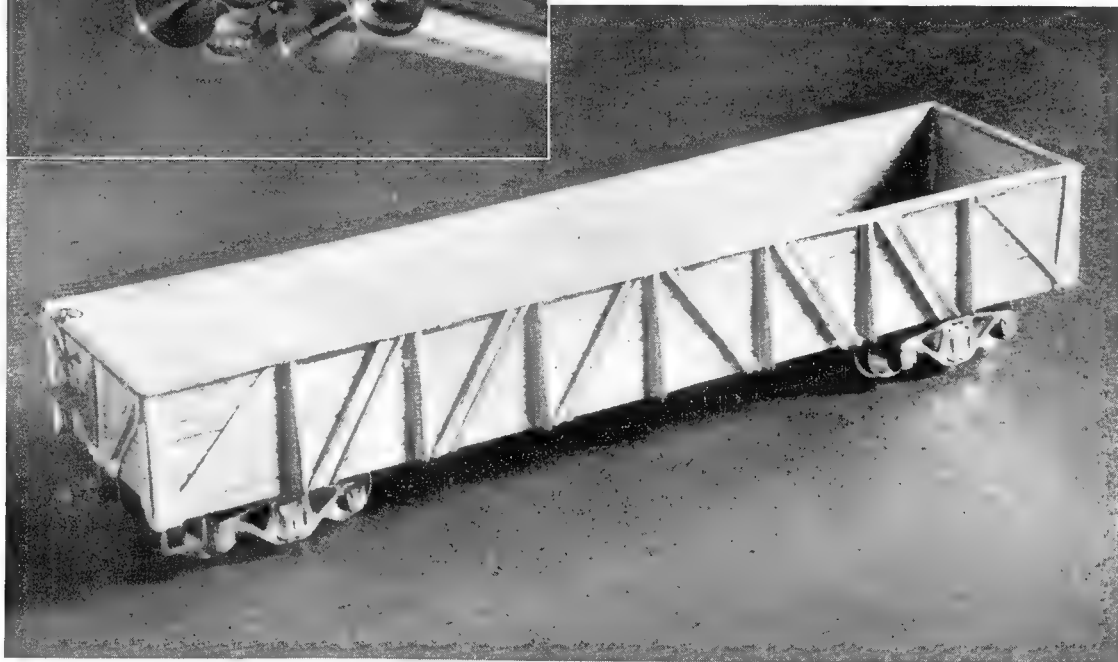
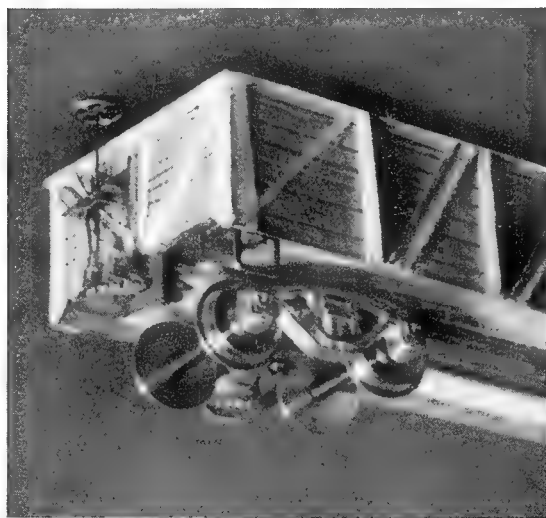
HAVE you ever seen a string of gondolas—loaded with various materials such as coal, iron ore, sand, orange-painted structural steel, and rock—rumble across a grade crossing? A scene such as this is all that is necessary to start you on a gondola car construction binge.

Loaded model gondolas are fitted with false bottoms to cut down on unnecessary weight. A sprinkling of coal, stone, ore, etc., mixed with glue to cover the false work, is all that is necessary to complete the illusion of a weighty load, and this effect tends to compliment the power of the locomotive hauling the cars.

Composite gondolas for the various gauges

can be made up from a number of different materials which vary in thickness depending upon their character, and for this reason the drawings on pages 22 and 23 do not show the thickness of the material used. For example, the sides and ends of the car can be constructed from sheet metal or wood. In the latter case, a choice is made between pine and balsa. This choice of material also holds with regard to the various braces, angles, etc., that are fitted to the car. Some modelers prefer to build entirely of wood and cardboard, while others enjoy working with metals. A third group will find a combination of the two materials to their liking. It's a matter of individual preference, and good points can be accredited to all of the materials.

For permanency, there is no doubt but that brass or tinplate is the better material. A better looking flange is obtained at the top of the car sides, and the braces, soldered in place, will stand the gaff better over a period of time. On the other hand, if balsa or pine is used for the body, a number of the parts can be glued in place, thus eliminating the troublesome job of soldering parts together (and some fellows do consider soldering as troublesome). It should be



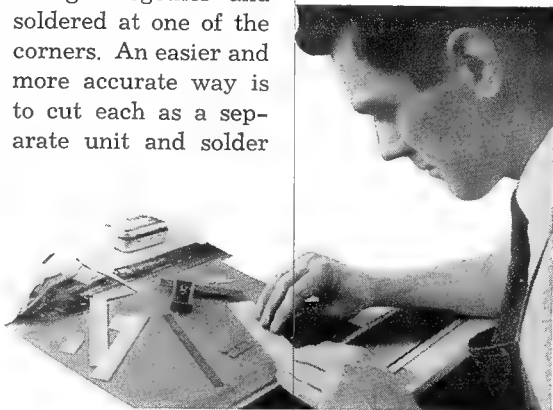
understood that a fineness of detail will be lacking if cardboard and wood are used, because the parts must be over-emphasized in order to obtain the same degree of strength. Roughly, that's the story with regard to the suitability of materials. You make the choice.

Full size O, OO and HO templates for the ends and sides of the car are shown in the drawings, and these measurements can be transferred to the car material by using a scribe. If tinplate is to be used, obtain a piece that is about .012" thick, suitable for any of the three gauges. Tinplate can be obtained from your local tinsmith, and Patterson Bros., 15 Park Row, New York, N. Y., are able to supply brass materials. If wood is to be used, obtain sheets of balsa or pine from your local model airplane store, using $\frac{1}{32}$ " thick material for the sides and ends of the HO or OO gauge car, and $\frac{1}{16}$ " thick stock for the O gauge car. Either $\frac{1}{8}$ " or $\frac{1}{4}$ " thick material can be used for the bottoms of any of the models. One advantage of using a wood floor is that, in this day and age of two-rail operation, it insulates one truck from the other. A few metal angles soldered to the inside of a model car will offer support for a wooden floor in the event that you want to carry this idea out in your model. Otherwise the truck will have to be insulated from the car by using either an insulating bushing to receive the truck kingpin or by equipping the trucks with a complete set of insulated wheels instead of insulating only one side of the truck.

Lay out the sides and ends and scribe them as shown in the templates before making

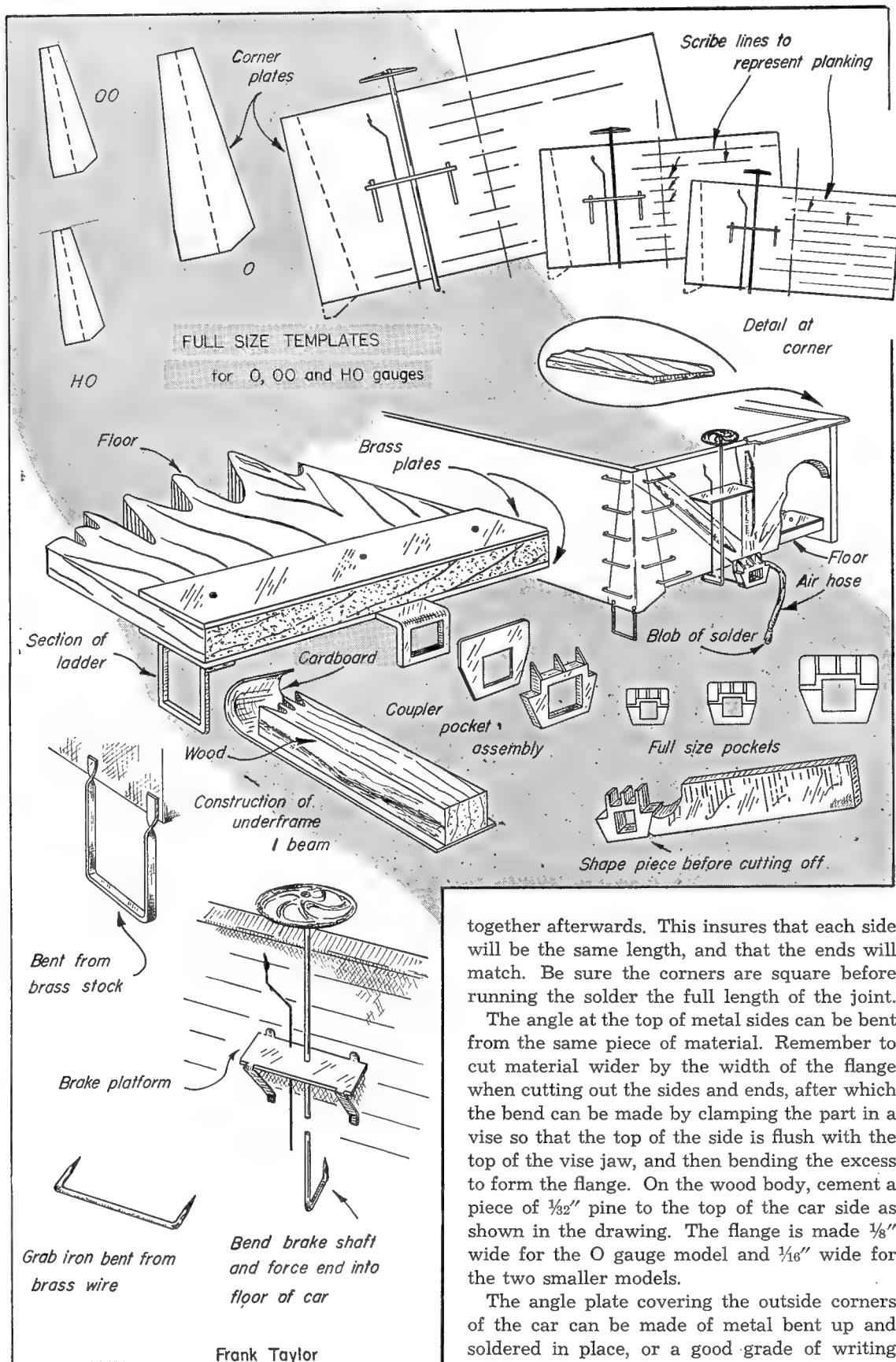
the assembly. If the body is to be made of wood, allow for the thickness of the sides when cutting the ends to length. Otherwise the car will be too wide. The sides should overlap the ends in making the corner joints. Notice that the end templates show the full width of the car. The wood car construction is shown directly beneath the end templates in a break-away view. Using metal for the sides and ends, it will not be necessary to make allowance for material thickness because the stock is so thin.

The two sides and two ends can be bent up from one long strip of metal and the ends brought together and soldered at one of the corners. An easier and more accurate way is to cut each as a separate unit and solder



Directions, Plans, and Full-Size Templates for O, OO and HO

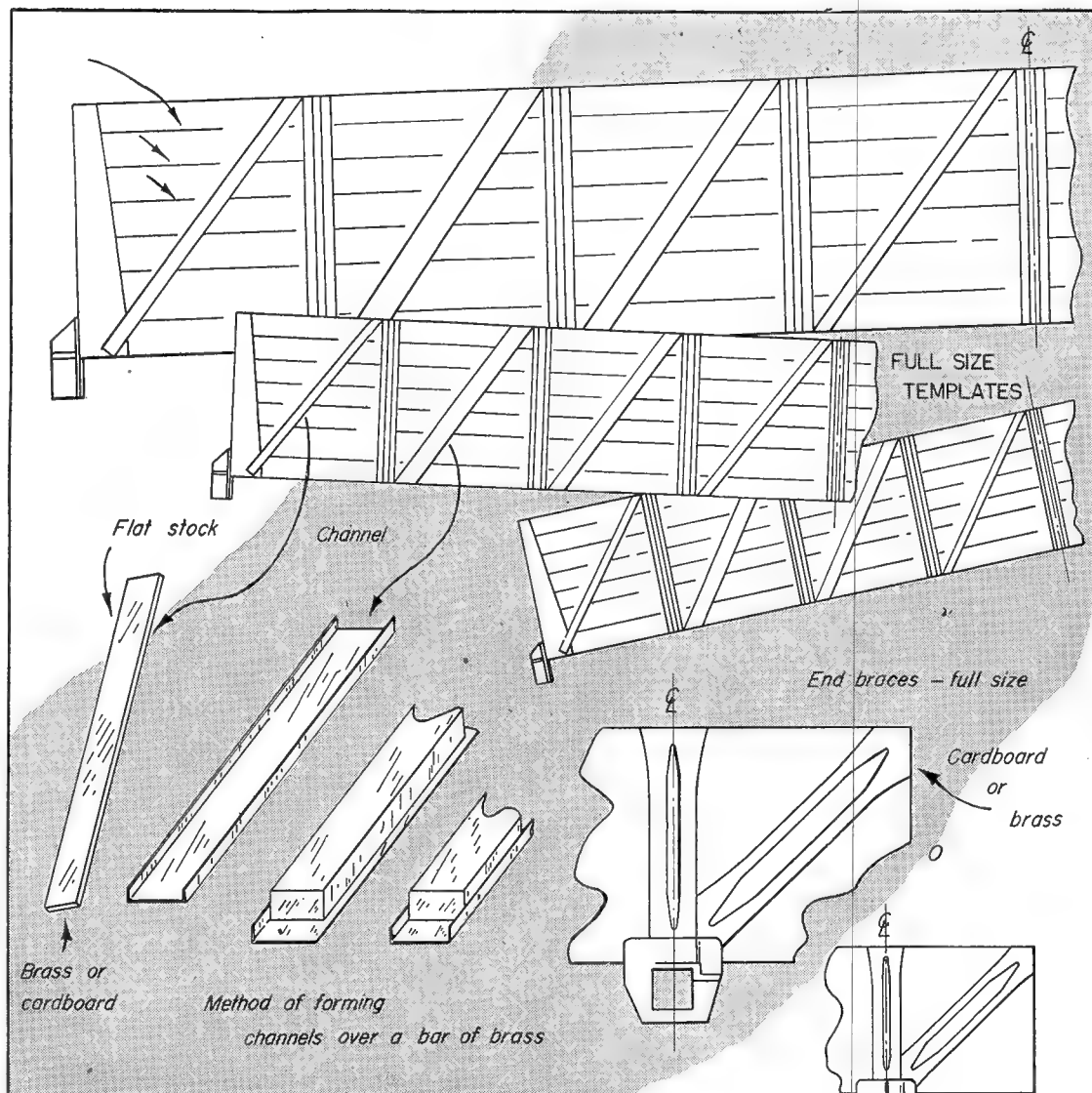




together afterwards. This insures that each side will be the same length, and that the ends will match. Be sure the corners are square before running the solder the full length of the joint.

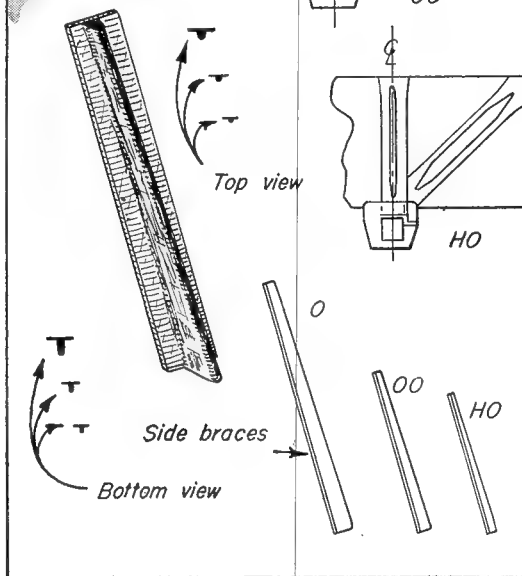
The angle at the top of metal sides can be bent from the same piece of material. Remember to cut material wider by the width of the flange when cutting out the sides and ends, after which the bend can be made by clamping the part in a vise so that the top of the side is flush with the top of the vise jaw, and then bending the excess to form the flange. On the wood body, cement a piece of $\frac{1}{32}$ " pine to the top of the car side as shown in the drawing. The flange is made $\frac{1}{8}$ " wide for the O gauge model and $\frac{1}{16}$ " wide for the two smaller models.

The angle plate covering the outside corners of the car can be made of metal bent up and soldered in place, or a good grade of writing



paper can be used as a substitute and glued on a wood car. Templates for these angle plates are drawn at the top of page 22, and the side and end views show the application.

Lay out the position of the vertical braces on each side of the car. Notice that there are seven of these, including the one located at the center of the car. These can be fashioned in metal by cutting a piece of tinplate to the width shown on the templates, and the length cut to equal the height of the side. Fourteen of these will be necessary along with 14 pieces of $\frac{1}{32}$ " square brass cut the same length as the tinplate strips for HO and OO gauge, and $\frac{1}{16}$ " square brass cut a corresponding length for the O gauge model. Solder the square brass strip to the flat piece as shown in the perspective drawing at the bottom of this page. After the square piece is centered and soldered, file it to the shape shown. The 14



assembled vertical braces can be soldered to the sides in the locations previously determined. To duplicate this in other materials, the flat piece is cut from paper stock and glued directly to the car side, and a $\frac{1}{32}$ " or $\frac{1}{16}$ " square piece of wood centered and glued in place, after which the square piece is sandpapered or filed to shape.

The diagonal channel braces which are placed between the upright braces are of various widths. Actually, the channels toward the center of the car are 4" wide and those somewhat nearer the end are 6" wide, and the next are 8" wide. The diagonal brace between the end of the car and the first upright brace is not a channel, but a piece of flat stock as shown.

The sketches beneath the side templates show a finished channel and the way to bend this up out of stock. Notice that one lip of the channel is bent over the edge of a piece of brass bar which has previously been filed to the correct width. The next operation shows the opposite lip of the channel being bent up around the other side of the brass bar. Clamp the parts in the vise to facilitate the bending operation. File the two lips to conform with each other after the brass core is removed. As before, solder the parts to the metal sides. An alternate way of making up the channels is to cut paper strips wide enough to form the base of the channel and then glue a strip of thin wood or thread along each side to create the channel effect. The end braces are made up in the same manner. Refer to the drawings.

Some thought is given to the method of fastening the coupler pocket and stirrup steps to the car, as the steps, in particular, have an aggravating way of loosening up. By referring to the drawing, you will notice that the floor has been sandwiched in between two brass plates which extend from one side of the car to the other and can be $\frac{1}{2}$ " wide for all of the models. A hole is drilled through the plates and the floor at each end of the plate, and an ordinary pin is slipped through and soldered in place to hold the parts together. The bottom plate is shaped to include the coupler pocket bracket, and can be used to advantage when fastening the air hose, coupler pocket detail, brake staff, and, for the smaller gauges, the stirrup steps.

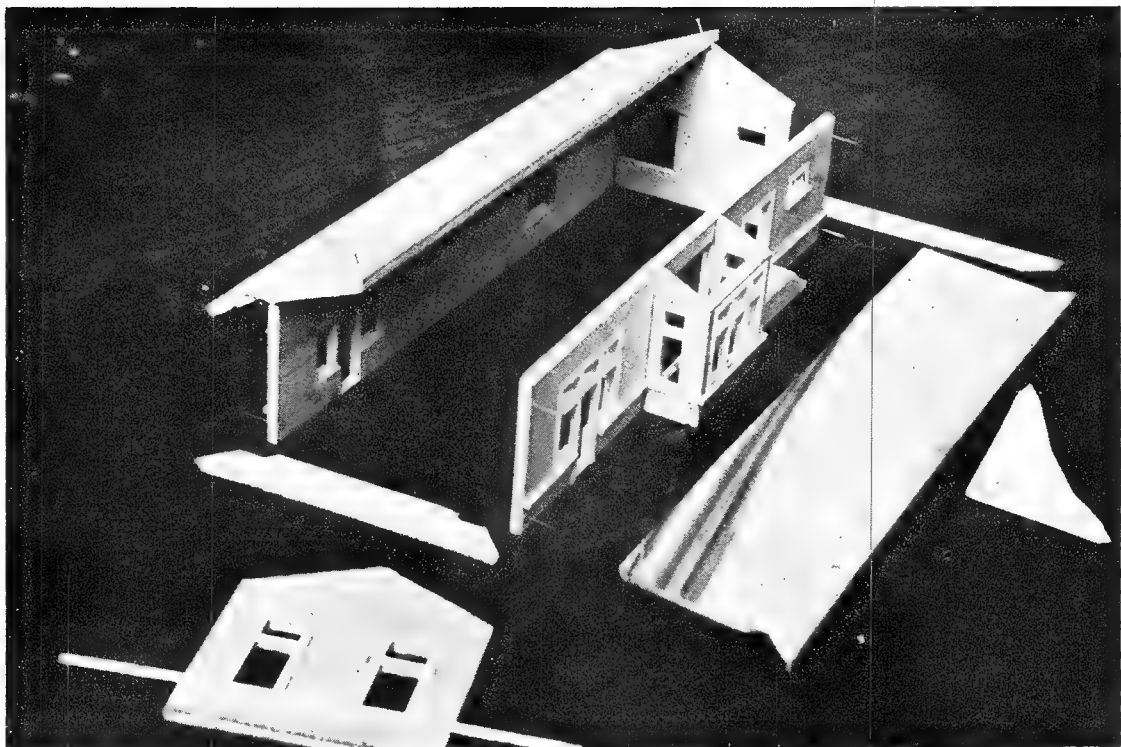
The various metal pieces that make up the coupler pocket are shown in the perspective on page 22 along with the templates of this part. Directly below the templates is a sketch showing the method of fashioning the coupler pocket detail from a piece of brass stock. A piece of .012" brass is cut to the size shown and the parts are placed together in their relative positions and

soldered. With the coupler pocket in place, as shown on page 23, slip a pair of freight trucks under the body and then determine how much the body must be raised in order to bring the coupler pocket to the correct height. The center of the coupler should be 10 mm. from the top of the rail for HO, 11½ mm. for OO, and $\frac{3}{4}$ " for O gauge. This adjustment will show you how thick to make the center frame directly above the trucks. Between the trucks, the underframe can measure 4 mm., 5 mm., and $\frac{5}{16}$ " square respectively for the various models. A strip of metal or cardboard, slightly wider than the wood underframe, is attached to the bottom edge to form a flange, as shown in the drawing directly below the floor view. The offset in the underframe is necessary because the bolsters of the different manufacturers' trucks vary in height from the top of the rail.

The grab irons are located as shown, and are bent up from half-hard brass wire. Drill holes in the metal sides to receive the latter and solder the ends to the inside of the car. If the grab irons are to be used on a wood car, clip the ends off at an angle to form a point for easy entry into the wood. There are staples on the market for use in office stapling machines that are just the right size for grab irons. They are priced reasonably and are uniform in shape.

The couplers can be fastened in place with a machine screw, or a common pin snipped off to length will be satisfactory for the smaller models. The screw or pin can be run through the floor and both plates previously mentioned and then soldered to the inside plate. The air hose is a piece of $\frac{1}{16}$ " or $\frac{1}{32}$ " round brass wire soldered to the inside plate, and a blob of solder at the other end simulates the hose connection.

The brake platform can be purchased or cut out from a piece of brass stock $\frac{1}{32}$ " thick for the O gauge model and .012" thick for the smaller models. The length of the platform is shown in the drawing; its width is $\frac{1}{4}$ " or $\frac{1}{8}$ ", depending on the gauge. The bracket can be soldered directly to the metal car end, or, if a wood body is used, solder the platform to the brake staff, which in turn is soldered to the metal plate at the bottom of the car. Drill holes in the platform for the brake staff and air pipe. Both of these wires are soldered in place at the bottom and a commercial brake wheel is fitted and soldered to the top of the brake staff as shown. On the same side of the car, locate the air brake cylinder, which is placed equidistant from each end and is fastened to either the wood center sill or the floor, depending upon the design of the casting.



Parts of station, showing assembly.

SMALL STATION

Construction Directions for a Combination Freight and Passenger Depot.

AS THE average model railroad is built in a confined area the wayside structures placed along the right of way should be of the smaller type in order to achieve a bird's eye view effect. The combination baggage, freight and passenger station pictured is small enough to fit in the average layout without monopolizing the attention of the persons present. Without the loading platform, it is 25 x 60 ft. The station signal and other equipment usually seen around a station is taken care of in the next chapter. In the meantime, this project will keep the construction gang very happy and contented 'til pay day.

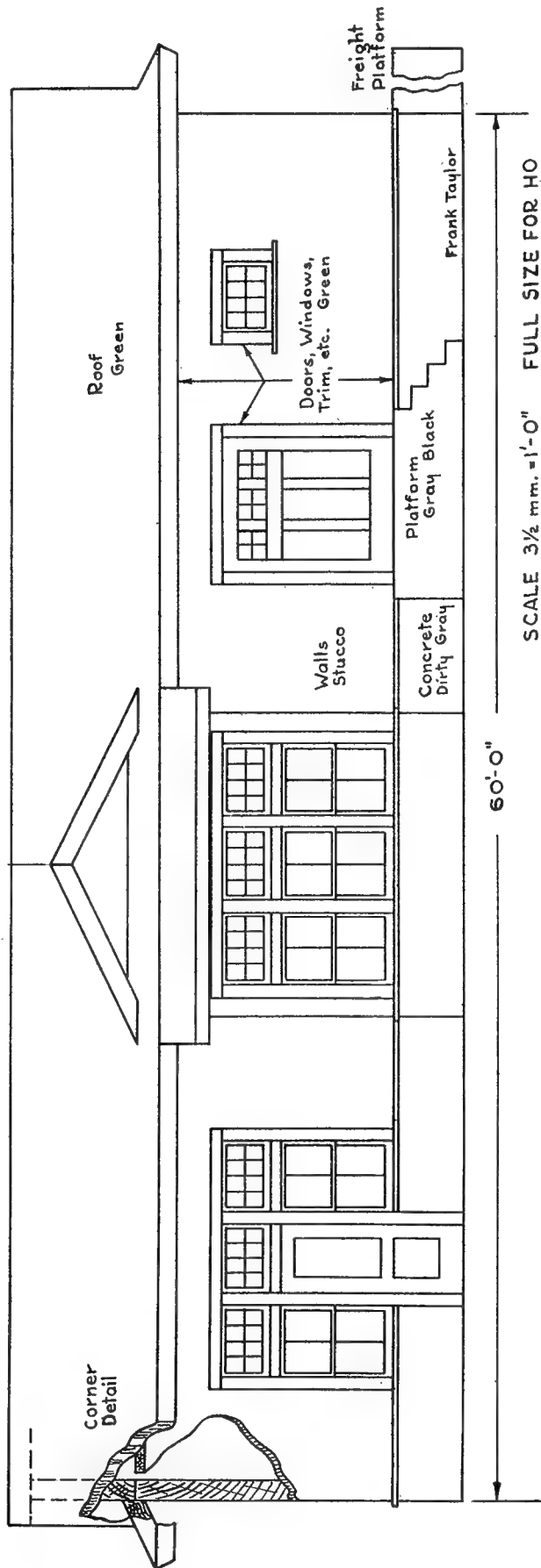
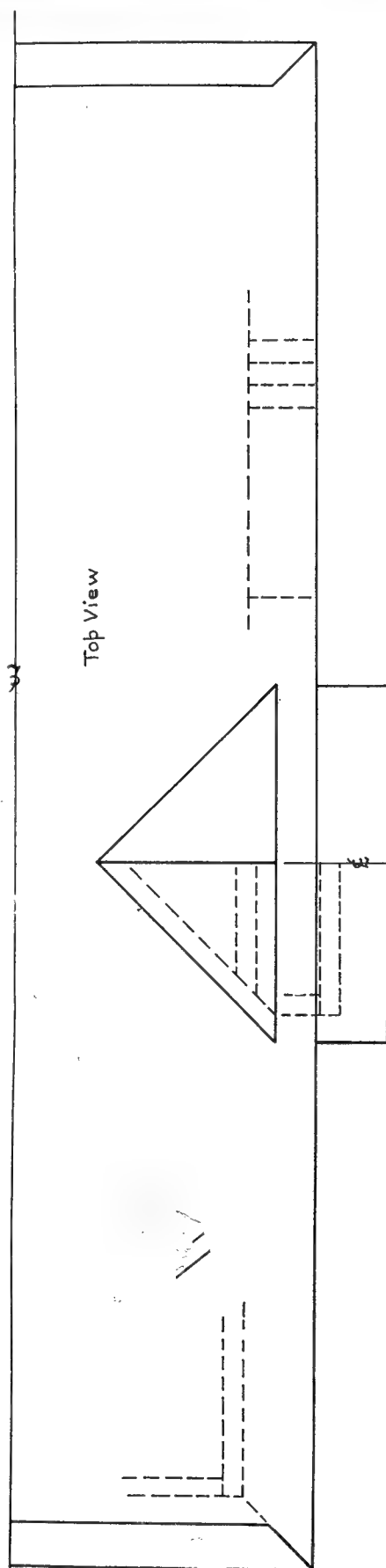
The materials to be used are cheap but should be considered carefully in estimating the labor involved and the durability of the structure. From past experiences and sad ones at that, it was found that the time saved in using cardboard was more than offset by the dissatisfaction in seeing the roof take on the shape of a Chinese temple and the sides warp after a short time to match the curved track. To avert similar disaster it was decided to use 3-ply veneer $\frac{1}{8}$ "

thick. Frankly, it ran up the labor costs, but the station is strong and will keep its shape indefinitely. If a power saw is not available, use balsa wood. It is easily cut with a razor blade or sharp knife.

Lay out the sides, ends, roof pieces and cupola parts and cut to size. The drawing is full size for HO but can easily be scaled to other sizes to suit your purpose. Buildings vary in height, width and length, so slight miscalculations on your part will not be noticeable, or you can make changes to fit your space requirements.

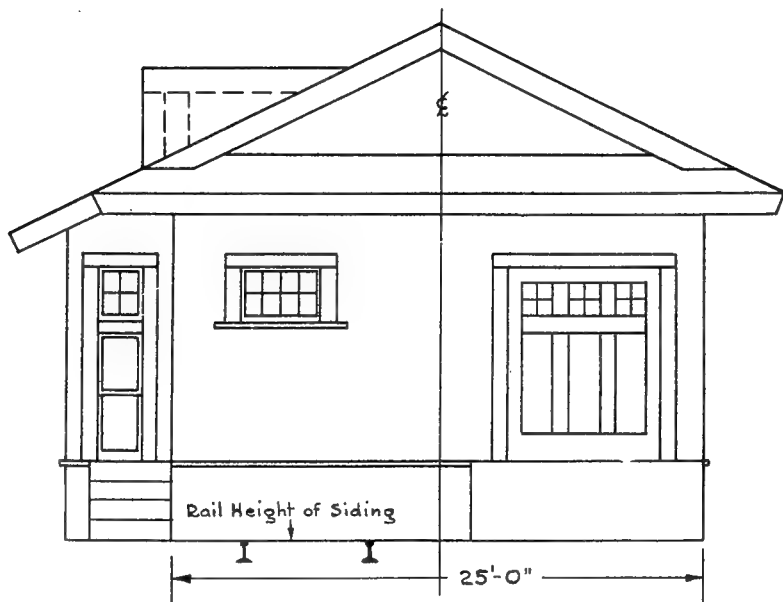
The roof construction at the ends of the building is a bit unusual and distinctive. When fitting the joints together use the trial and error method. Perhaps several pieces will be spoiled before a good fit is obtained, but the time and material involved is almost nil. The parts can be checked for fit by nailing them together with small bank pins. This should be a temporary arrangement and the parts taken apart after the checkup is made.

Next, lay out the windows and doors. The adjustable square and a sharp pencil will help



SCALE 3 1/2 mm. = 1'-0" FULL SIZE FOR HO

Plans may be used for any scale by taking off actual dimensions by means of an HO scale rule, obtainable from any model shop or HO manufacturer.



do the trick. An opening in the side, directly behind the operator's cupola, will make this projection a part of the building proper and thereby allow light to shine through all of the windows, assuming, of course, that a light will be installed inside the station.

The openings can be cut out in several ways, depending on the tools on hand and the materials used. If balsa wood is used a razor blade can be employed to remove the bulk of the wood. Plywood is tougher so resort to the use of a drill and jewelers' saw to do the same job. A series of holes drilled around the inside of the layout lines will allow the excess to be knocked out. In using any of the above methods some stock should be left so that the openings can be filed square and true to the layout lines. There is a trick in doing this, one that tool and die makers resort to in making openings in metal to an exact size. When the opening is roughed out, place the piece flat on the opened jaws of a vise or hold it down with the opening projecting over the edge of the bench and proceed to file, using an up and down motion. Hold the piece with one hand and file with the other. If you have a clear mental picture of this method of filing, the ease

End elevations on this page are full size for HO, 3.5 mm. = 1'-0" scale.

up complete on the bench and then glue them in the proper openings. Paint the openings and trim before installing the window material.

The window arrangement is the same for both front and back of the station except for the three windows in the operator's bay. At the rear make two high windows, such as those installed in the freight room, just opposite or to the rear of the operator's space. These are for the toilets usually located in this space.

The window material (celluloid, paralin, or what have you) can well be glued directly to the inside walls of the station, but if that realistic effect is desired it will be required either to

and accuracy with which a scribed line can be filed to will be appreciated. The big advantage is that the layout line is always in view. That extra swipe that we all like to take when the work is clamped in the vise and both hands are on the file oftentimes is all that it takes to ruin the work. What is good enough for men in skilled trades should be a good method for us. This kink is strongly recommended for loco cab and coach windows.

Cardboard or thin balsa strips are glued in place to simulate the door and window trim. Make the doors





cut the windows to fit the openings and glue them in a slightly recessed position or cut down on the thickness of the wall material.

Glue and nail the wood parts together. Use bank pins for nails and in driving these in clip off the heads before making the final blow. Sand the joints smooth before gluing the square molding to the sides and ends of the building at window sill height.

The platforms fastened to the outside of the station should be made to suit your traffic problems. Suffice to say that they are 8 to 10 ft. wide

as a rule and are as high as the bottom of the freight doors. Planks about 8" wide can be scaled down and scribed in the wood. Chimneys with double flues are usually 18" x 24" and should project at least 2 ft. above the ridge of the roof. Scale down and glue in place. The chimney is placed above the theoretical wall separating the waiting room from the operator's quarters, as shown in the photos.

Cut an extra roof section to cover the front of the cupola and the parts to make up the gable located above the cupola. Measure or scale

from the drawings for the dimensions of these parts. Glue and nail in place.

The window lights can be separated by drawing lines with black india or celluloid ink. Applying celluloid ink with a draftsman's ruling pen will give the best results.

To give the stucco effect to the walls, paint them white and while the paint is still wet sprinkle heavily with fine sand. The roof finish is effected in much the same manner. Use brown paint to coat the surface and while this is wet streak the color with green. Use plenty of paint. Blow cement dust evenly on the wet surface; this will give the rough effect of roofing paper. The walls, from the base to the molding, are painted white and then streaked with brown, green, and black. Use these last colors rather

dry, that is, do not have much material on the brush.

For the weather beaten effect or downright dirtiness of some country or small town stations put a little black in the brush and then dip deeply into the turpentine can. Apply this mixture to the sand below and around the windows and doors. Smear some on the doors where the wear would occur in reality. The station will fit into the picture better with a slightly aged appearance.

Locate the station and nail four wood cleats to the table in a position so that the walls of the structure will just slip over the outside of them. This will allow lifting the station for bulb replacement or repairs and at the same time will keep it in position when placed there.

STATION ACCESSORIES

Train Order Semaphore and Express Wagon to Go With Small Town Station.

A RAILROAD station without the usual express wagon, train order signal, and freight packages, seems incomplete. Small, lifelike figures also help to complete the picture, but, as these are on the market at small cost, it is assumed that they will be bought.

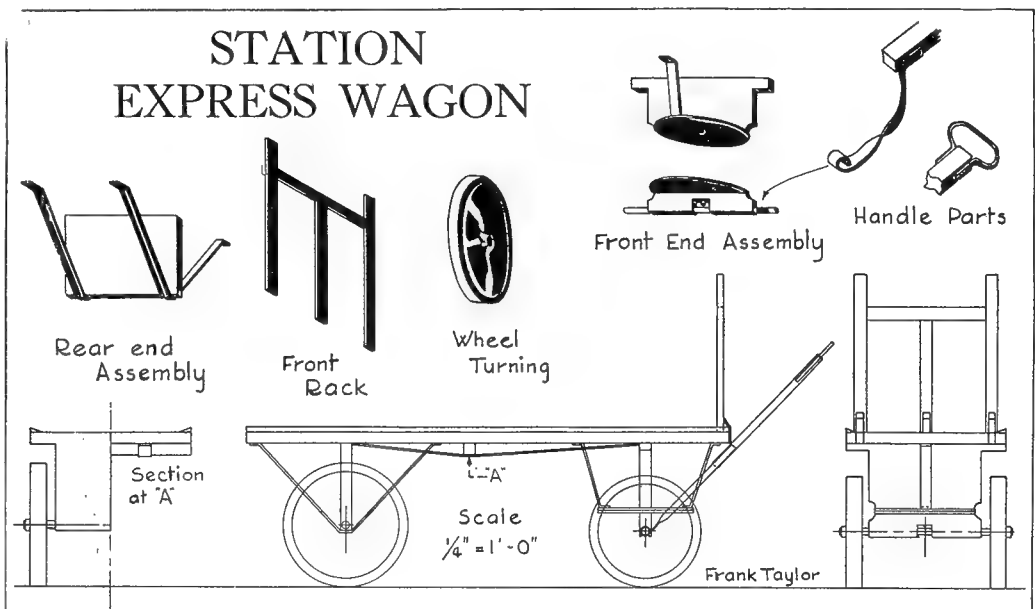
The express wagon is made up of stock materials and no special parts need be purchased. For example, the platform of the truck can be made using $\frac{1}{16}$ " flat brass stock. Wood can be used but it will be easier to fasten the braces, cross members and other parts to the platform securely if the parts are soldered together. After the platform is filed to the desired size (O, OO or HO), scribe lines across the piece to represent 8" planks. Then file the surface smooth, as the scribe oftentimes kicks up an edge that is obviously unrealistic and tends to defeat the attempt made to model the planks. Little attentions to detail in execution help toward acquiring that illusive professional touch. Cleaning up the soldered joints is a strong point that bears dividends, so remember these suggestions and a better model will result.

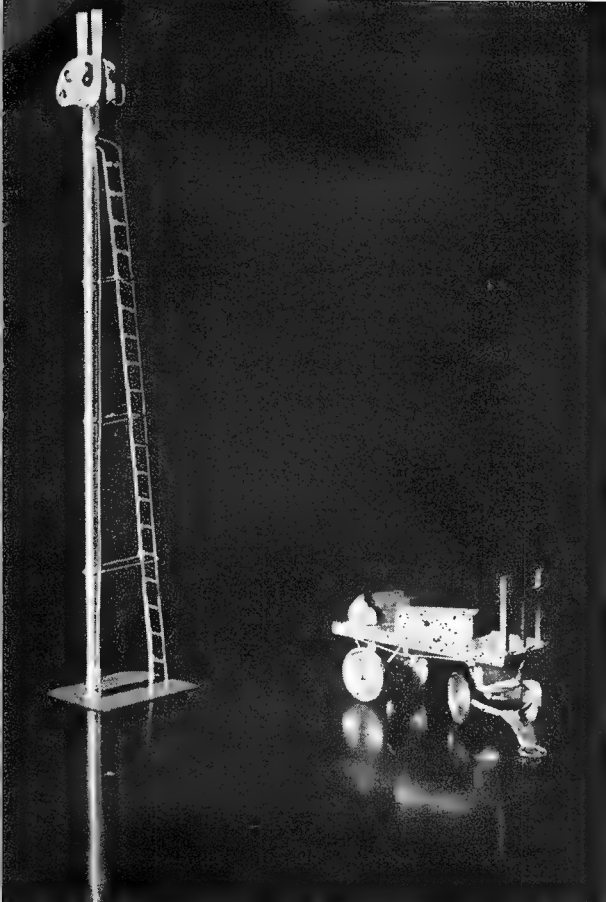
Next, lay out the axle center lines on the bottom of the platform. These lines will help to locate the bolsters shown in the perspective. Notice that the support for the fifth wheel or turntable is slightly different in shape than the

rear axle bolster. Use $\frac{1}{16}$ " brass stock for these. The finished parts are soldered to the platform. For simplicity, the fifth wheel is modeled by using two thin disks of metal. One of these is soldered to the front support, as shown, and a hole is drilled through the center of the disk to take the king pin. The king pin can be paper clip wire or an ordinary pin if other wire is not at hand, and should be soldered in place. The other disk is soldered to the axle bolster as in the lower half of the front end assembly drawing. A notch is filed in the lower half of this unit to allow the head of the king pin to be peened over. Slots are filed for the axles to lay in and when this is done the axles are soldered in place. Cut the axle stock sufficiently long to extend through the wheels and for peening over.

The braces are made of strap material on the real thing and can be cut from thin sheet stock for use on the model. These are bent to the shapes shown and soldered in place. Notice that the straps wrap under the rear axle but are soldered to the upper side of the turntable.

Make up the tongue or handle parts and solder them together. Two pieces of strap material are made to form the wishbone, the ends of which are bent around the axle. To prevent unwrapping at these points, touch slightly with solder, making sure they are not frozen to the





Complete HO models as described.

axle in the process. This would prevent the tongue from raising or lowering. There are two rods running lengthwise on the underneath side of the body to prevent sagging. These wrap under a spacer as shown in section A. The spacer is made of square brass stock, and wire that does not look disproportionately heavy is used for rods. These are soldered directly to the bottom of the body.

Although some filing is necessary in using this method, it will be found best to fashion the front rack or stake assembly out of one piece of brass. It is easier to handle and will not become unsoldered in the process of fastening it in place.

Two strips of brass are soldered to the platform, ostensibly to prevent the luggage from falling off the sides of the truck. It might be necessary to clean out the cracks between the planks if the solder flows too far in the process of fastening on these strips. It will help if the solder is applied from the outside and allowed to flow toward the center of the platform. The excess can also be filed off more handily. Bevel the tops of these strips with a file. See drawing.

The wheels are simple turnings. No attempt is made to duplicate the spokes because there are too many of them and the difference in effect does not compensate for the time and labor in-

involved. The wheels are slipped in place and held there by peening over the ends of the axles, and should roll freely after this operation.

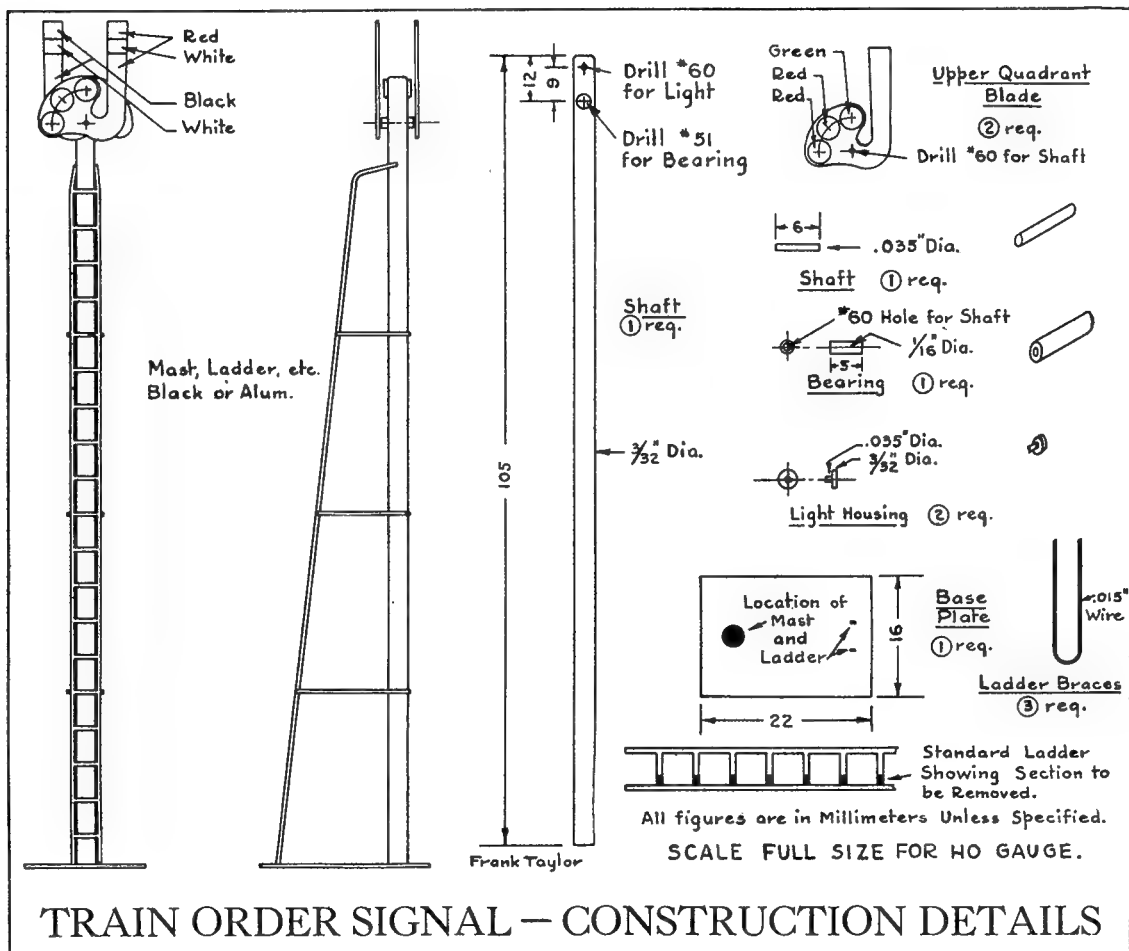
The wheels, turntable, bolsters and handle are painted red and the rest of the model green. RAILWAY EXPRESS AGENCY is painted on each side of the truck in yellow and some trimming, such as the handle (loop of wire), can be done in black.

With the above models in use around the station, it is only a logical step to plan for the addition of a train order board. All small stations have these except at division points where all trains stop, or perhaps at a station that is so small that it is not used for train order purposes. The signal is operated manually by the telegraph operator and agent and this action can be carried out by the modeler by bringing a set of rods within easy reach which will actuate the blades. That would be realism plus. Trains not scheduled to stop can be made to do so in the conventional manner or the signal can be used for manual block signaling.

The mast is made of solid rodding. The controls are on the outside of the mast in real practice so tubing will not be necessary. A mounting or base plate is made up of thin sheet brass or tin stock. As this plate will be covered by crushed rock (in effect) and is used solely for mounting purposes, it can be made any convenient size. Solder the mast to it in the position shown and proceed to lay out the two holes in the opposite end of the mast. The sizes shown will be convenient for any of the gauges. Be sure to drill the holes in the right direction; otherwise the ladder will lead up from the track. This, obviously, would put a man's life in danger because of close clearances. The bearing also acts as a spacer for the blades. This can be turned up and pressed in the hole or soldered in position if a loose fit is obtained.

Turn up two buttons to represent the light housings and press or solder them in position. Follow your own inclinations in placing a pinnacle on top of the mast. Some roads use them on a signal of this type.

To make the blades for the larger gauges, draw checkerboard lines on the template shown, spacing the lines $\frac{1}{8}$ " apart. Then draw a duplicate set of lines on a piece of paper, spaced in proportion to the difference in gauges. For O gauge, the lines would be spaced 10 per cent less than double size or almost $\frac{1}{4}$ " apart in each direction. The outline is then drawn in each large square as it is seen in each small square. To eliminate any discrepancy in the position of the light signals, draw an arc with a compass equal or in



proportion to the one shown on the drawing. This line should split the centers of the three lens openings to allow the mythical light to register and shine through each lens as the signal blade is correspondingly set. The lenses are 45° and 90° from the vertical. Next, transfer this outline to a sheet of brass or tin and fashion to shape. The best method of doing this is to cut off all the excess stock conveniently possible with tin snips and then file to the scribed contour as explained in the small station project on page 25. Due to the lack of stock between the lens openings, drill these out undersize and then open the holes to full size with a small round file.

The blades are mounted by slipping a piece of .035" wire through the holes provided in the blades and the bearing. The ends of the wire are then snipped off and peened over to prevent their working loose.

To save some work, a suitable section of punched ladder material should be used. This can be narrowed to look like the ladders used on signals by practically cutting the ladder in

half. The rungs are then cut off flush on one side and the remainder of the ladder soldered together. Refer to the drawing. One end of the ladder is bent, as shown, and the two top rungs removed. Solder in place. Three ladder braces are made of thin wire. These are spaced evenly on the mast and soldered to both it and the ladder. Then snip off the excess wire.

The rods used to actuate the blades are made of brass wire. If the signals are to be made workable, the rod will have to be bent over at one end and passed through a hole near the base of the blade. By use of a ball crank, located at the base of the signal or below the baseboard, the motion can be transmitted to the edge of the table or within reach.

Instead of trying to fit a piece of celluloid or cellophane in the lens opening, try this wrinkle. Dip a match in some airplane dope. With a generous blob of it on the end, twirl the match in the opening and then gently withdraw. A perfectly fitting transparent lens should result. Lamp coloring fluid or paint can be applied after the lenses are dry.

THREE-POSITION SIGNAL

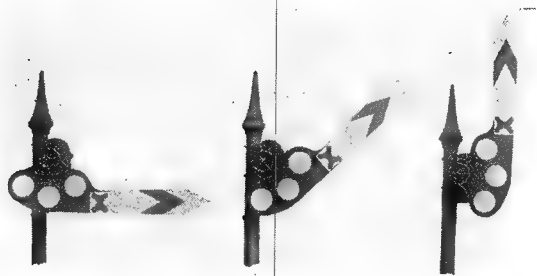
A Semaphore Which Automatically Throws to All Indications.

THE somewhat outmoded semaphore blade used for block and interlocking signals has one or two outstanding features that adapt it to model railroad practice. To know what the signal indication is without having to look at the face of it is very desirable and in addition the motion of the blades is something a person enjoys watching.

As the majority of the installations in recent years have been of the three-position upper quadrant type, one of the most typical is modeled. The big bugaboo in modeling this type of signal has been to get the blade to function in three positions. When the blade is normally vertical the indication is clear, when the blade is at the upward angle of 45° the indication is proceed prepared to stop at next signal, and when the blade is horizontal the indication is stop. To have the blade behave in a railroadlike manner two solenoids are arranged to supply the necessary impetus to the blade at the proper time. In addition, three lenses—red, yellow and green—are installed in the positions shown. These are illuminated in turn as the blade indicates, by means of a beam of light which is projected upward from below the table. This method of illumination allows the signal to be built to scale and works out nicely.

A study of the drawings and sketches will acquaint you with the different parts and their duties. Notice that the signal can be removed without disturbing the assembly beneath the table and vice versa. A counterweight is placed on the upper rod to allow the blade to return to normal after the solenoids are de-energized.

The signal is a project in itself and the construction will be explained so that those interested in the different gauges will know what materials to use, as these will vary depending upon the size of the model. The solenoids and other parts that comprise the substructure will be described without regard for gauge or scale.

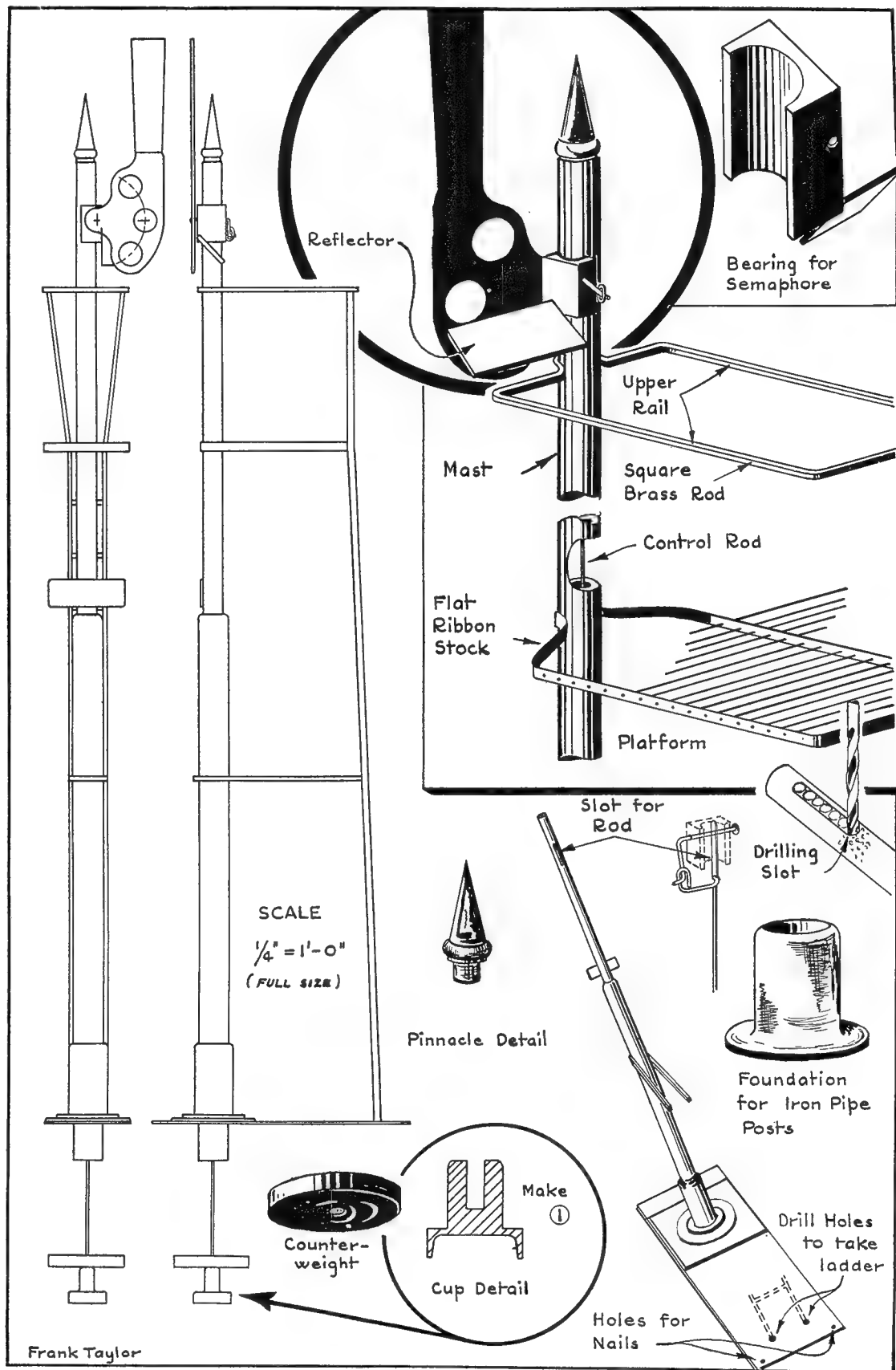


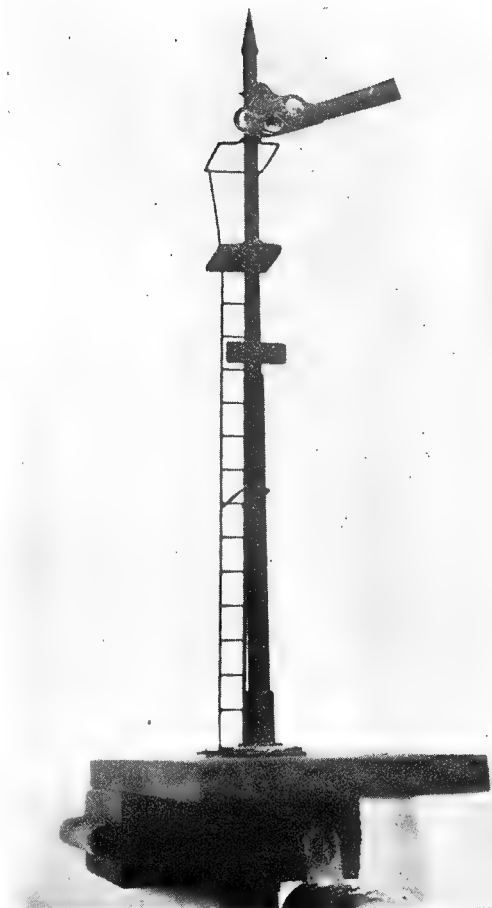
Lay out the blade and spectacle on a piece of sheet stock (.012" brass), then cut and file to shape. A square end blade is used for interlocking and for absolute automatic signals on single track, while pointed end blades are used for automatic block signals. The fish tail type is used only for distant signals. The spectacle is a casting, ribbed for strength, and incorporates the three lens openings and a flat socket for the blade. The blade is bolted to the spectacle on the prototype but the two are modeled as one piece as just mentioned. The lens openings should be drilled undersize and then filed to the correct aperture in order to insure proper alinement. Slip a bank pin through the pivot hole provided and solder it to the spectacle.

The pipe or pipes used to support the semaphore arm are duplicated in brass tubing. These masts vary in height and are usually made by telescoping one pipe into another of a slightly larger diameter when the mast exceeds 20'-8" in height. A piece of brass tubing corresponding to 9", the diameter of the full size mast at the base ($\frac{3}{16}$ " for O gauge, $\frac{3}{32}$ " or $\frac{1}{8}$ " for the two smaller gauges) is used for the mast. The wall of this tubing should be of sufficient thickness to allow half the length of the mast to be turned down to the equivalent of 7" o.d. of the full size mast. This forms the upper half of the mast. Turn a pinnacle to the shape shown with a shoulder at the bottom to fit snugly into the tube. If a snug fit is not obtained, the part can be soldered in place.

Two plates are made of sheet stock to form the foundation for the mast and also a means of fastening the bottom of the ladder. See the drawing for comparative size. Drill a hole in these to take the mast and two more to accommodate the ladder base. Solder the sheet brass plates together before drilling. A simple turning, in effect a tube with a washer attached to the end, is slipped onto the lower end of the mast; the mast is then passed through the base plates and the assembly soldered together. Check the work for squareness.

Make a bearing block from brass stock. When





fitted in place this will support the semaphore blade shaft. The block can be shaped to fit the mast by clamping a similar piece of stock to the block and then drilling a hole, the same size as the diameter of the mast, through the parting line. When the parts are separated, the half hole drilled in the block should offer a snug fit against the mast. A smaller hole is drilled to fit the semaphore shaft. Solder the block in place. Drill a series of holes and file out to form the slot in the upper side of the mast. See the sketch. The slot should be slightly wider than the wire used to actuate the blade. Music wire is a good material for this purpose and can be procured from any model airplane supply house. Bend this wire and the semaphore blade shaft as shown. Some slight adjustment will be necessary to make the action work freely. This is a job that need be handled but once.

The ladder can be built up or one of the punched-out variety used. If one is purchased be sure it is the narrow type rather than the kind used on box cars. Notice that several of the top rungs are removed for convenience of the ladder climbers. Bend a frame, to be used as the

railing, out of $\frac{1}{32}$ " square brass (for all gauges). In bending this and the other parts that go to make up the model it will help considerably if you refer to the drawings and sketches. Solder the railing to the mast with the ends butted together at this point for strength. Spread the rungless end of the ladder and solder the ends to the inside corners of the railing. Slip the legs of the ladder into the holes previously drilled in the base plate and flow solder in place from below. This will make a very strong joint and the method will save cleaning up the excess solder.

Solder two pieces of ribbon brass, about $\frac{1}{16}$ " wide or less, together, and drill a series of holes to take the rods which form the base of the platform. Unsolder the parts and form them to the shape of the platform. Then insert lengths of music wire, as shown, and after alining and squaring the parts solder them together. Use the same materials for all gauges. The lower brace, supporting the ladder at its center, is made of $\frac{1}{32}$ " square brass. Prepare a number plate from .012" sheet brass and solder it to the post.

The reflector used is a chromium plated piece of brass soldered to the side of the bearing block. To cut down on the cost, a piece of plated house hardware was picked up at the dime store. With one slice missing there is plenty left for the rest of the signals on the pike.

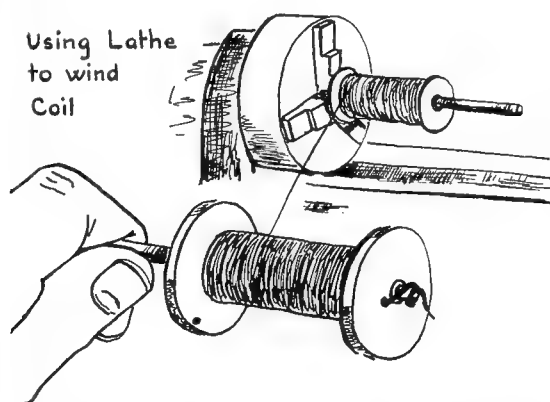
Turn a cup socket for the lower end of the rod. Slip a counterweight of the size shown on the rod first and then solder the cup to the rod. The combined weight of these parts should tend to keep the blade "clear."

In painting the model a choice of colors can be made. The mast, for example, is usually treated with aluminum or black, but box car red could be used correctly as this is specified on the CB&Q. A choice can be made in painting the blades too. The typical colors used on square and pointed end blades are red with white stripe, sometimes yellow with black stripe. On the Santa Fe, colors are black, white, or black and white striped according to background. Visibility is the strong point.

Signals are numbered arbitrarily, odd for one direction and even for the other, and often indicate the miles away from a terminal, as at 18 miles, the eastward signal might be numbered 18.0 and the westward one 18.1.

The second phase of the signal construction deals with the signal operating mechanism. This is simple to make and easy to adjust. Two solenoids form the nucleus of the device. A study of the drawings will acquaint you with the inner workings from top to bottom as the unit is shown through the center as if it were split in half.

For those of you who have difficulty in reading drawings let it be pointed out that the bulb is the only part not shown in section through the center because it is mounted off center to line up with the reflector on the mast. Notice that each solenoid can force its iron plunger upward to a working position without disturbing the parts of the other. In effect, each one works as if the other were not there. To increase or decrease the throw of the blade in caution or stop positions it is only necessary to reset one or the other of the collars on the lifting rod. A 2-56 set screw is used in each of these collars to simplify adjustment.



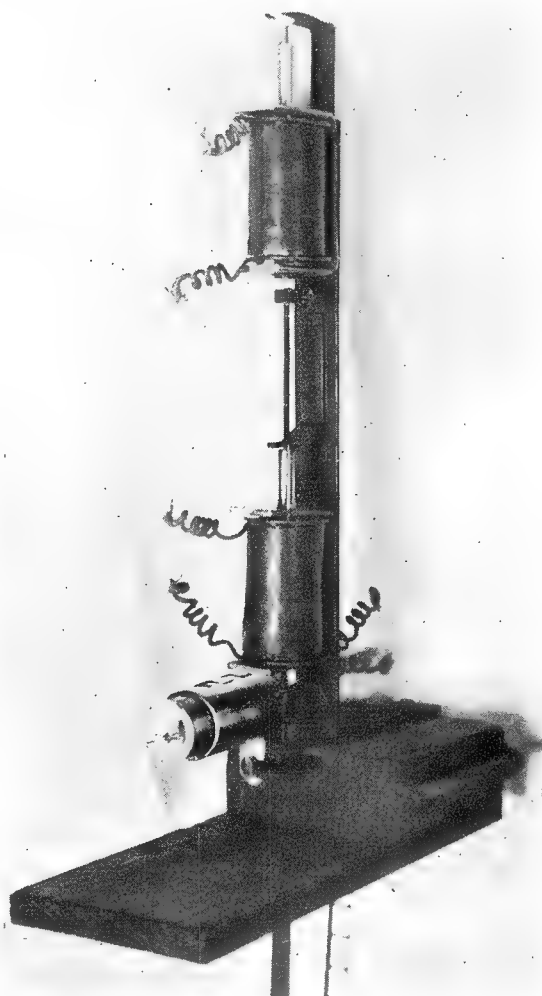
The solenoids are wound with No. 34 enameled wire in the manner shown, or, if a lathe is not handy, a hand drill can be used along with a little elbow grease. Even with the hand drill method, a complete winding does not take long. First, a piece of brass or copper tubing is cut to the length shown. Take dimensions directly from the full size drawing. Two fiber washers are also used for each unit. The center holes of these washers are bored a tight fit for the tubing. Also drill a No. 50 hole in each washer for the connecting wires and then force the washers in place on the tubing. (If you have trouble getting fiber, one of those cheap composition suitcases can be victimized.)

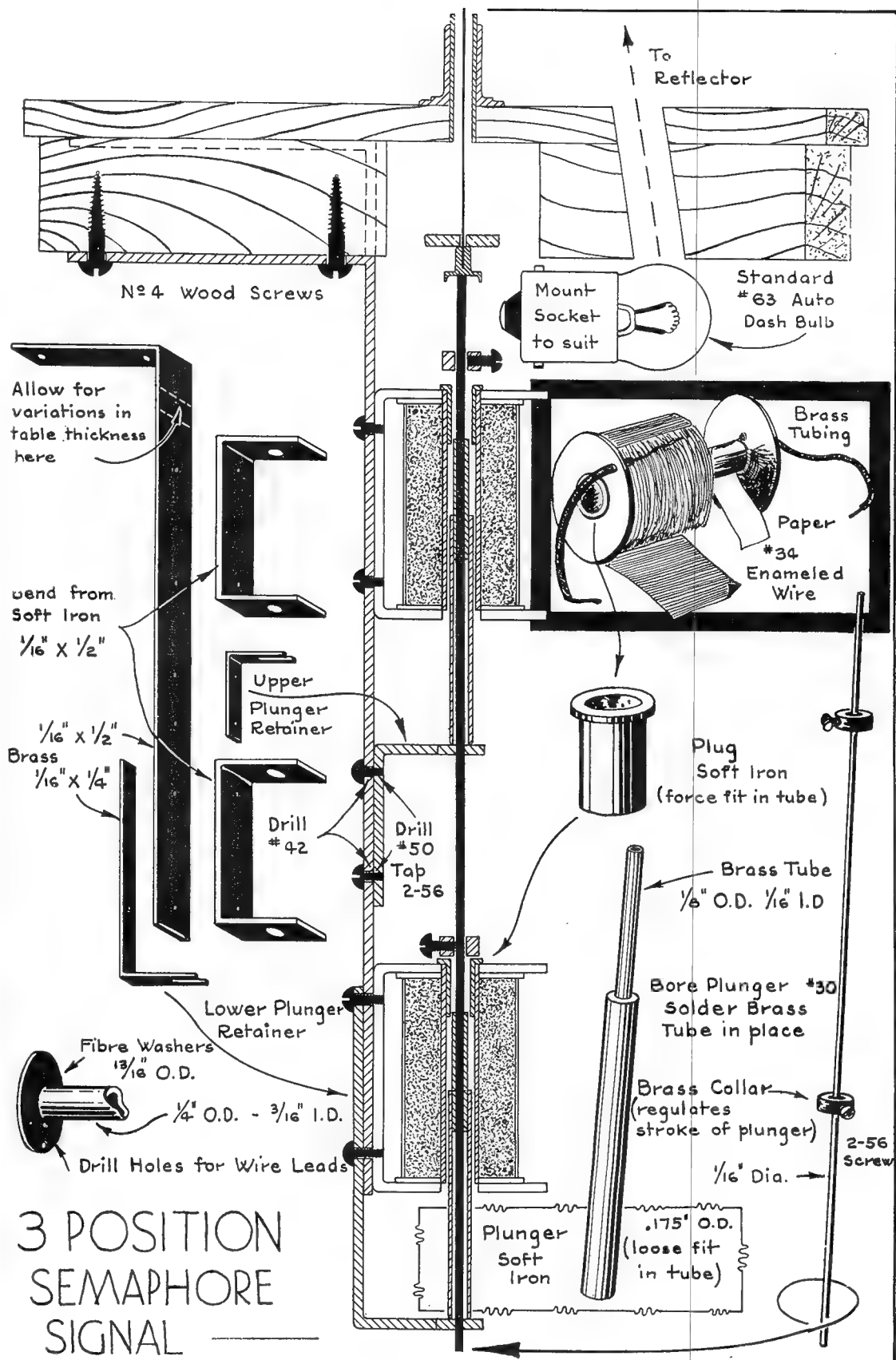
A piece of empire cloth or paper should be wrapped around the tubing to guard against shorts. Cut the material wider than the distance between the fiber washers so that a fillet is formed between the washer and the tubing. A piece of doorbell wire is fed through the hole in the washer (located near the tubing) and is then spliced and soldered to the No. 34 wire. Before starting to wind, wrap a piece of paper around the spliced joint to protect the succeeding layers of wire from the sharp edges. A piece of rodding can be slipped into the spool and the projecting end chucked in the lathe or hand drill. Burr the

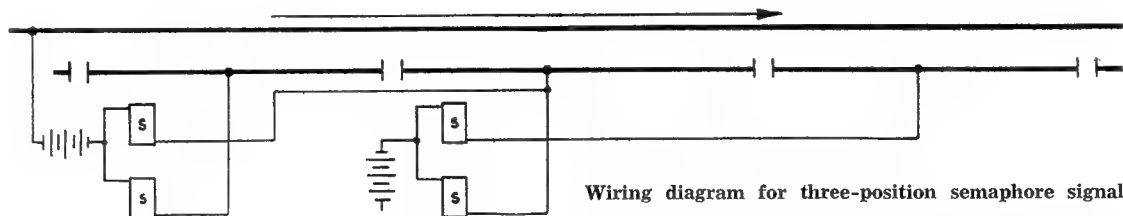
rod slightly to prevent the spool from spinning freely. Handle the wire carefully because the enameled surface is all that protects it electrically from its neighbor. Scrape the wire for soldering purposes.

The wire is wound on without much regard for evenness and is called "jumbled" by those who talk that language. Wind the spool until the diameter approximates that shown in the drawing, then scrape the wire; solder the end to another piece of bell wire, wrap the joint and lead the heavier wire through the hole drilled near the outer edge of the washer. A piece of bookbinders' tape is cut slightly wider than necessary and wrapped around the outside of the coil to protect it. Bookbinders' tape is like a postage stamp, even to the taste—lick it and it sticks.

Bend two U-shaped pieces from soft band iron to fit around the solenoids. Drill No. 50 holes and tap, as shown, for fastening purposes. A hole the size of the tubing is drilled on the respective top and bottom of each piece. Turn a soft iron plug for the top end of each solenoid and force in







Wiring diagram for three-position semaphore signal.

place. This plug limits the length of travel of the plunger, thereby definitely setting the blade to the same position each time the solenoid is used. The hole bored in the plunger for the free movement of the $\frac{1}{16}$ " diameter rod also acts as a cushion when the plunger snaps upward. More could be said about the different parts in a technical way but this would only confuse the average fellow who is only interested in the result.

The plungers are made of soft iron to cut down residual magnetism. If other iron is used it will have a tendency to retain or let the magnetism "reside" in the piece after the current is shut off. This is important. The plungers are bored No. 30 for the brass tubing (see drawing) and are soldered in place.

Make a mounting bracket out of $\frac{1}{16}$ " x $\frac{1}{2}$ " band iron or brass, drilling the holes shown, and fasten the upper solenoid in place. Next, make two plunger retainer brackets from $\frac{1}{16}$ " x $\frac{1}{4}$ " brass to the shape shown. Drill the holes and screw the lower solenoid to the bracket. A slot should be filed in the arm of each of these brackets to allow the push rod to function freely. Install the plungers before fastening the retainer brackets in place. The plungers should work easily—like a pile driver.

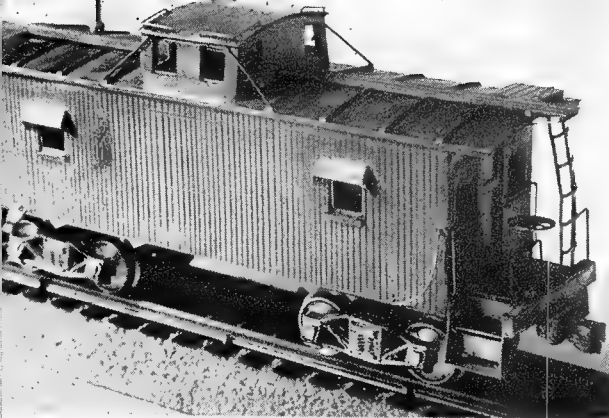
The two adjusting collars are drilled through

the center and from side to side with a No. 50 drill. Tap the last hole 2-56 for the set screws. Slip the $\frac{1}{16}$ " rod (shown) up through the solenoids, putting the collars on at proper intervals.

After the signal and mechanism are installed, the push rod is brought to bear against the cup socket, then the lower collar fastened in place on the rod. This collar lies against the lower solenoid plug when in place and the blade should indicate normal. Lift the lower plunger by hand 'til it hits the stop. The blade should be in the stop position at this time. So far, so good. Now fasten the upper collar at a position on the push rod so that when the upper plunger is fully raised the blade indicates caution. Use the hit and miss method.

A No. 63 auto dash lamp will suffice to illuminate the lenses. The accessory stores also sell a socket for this lamp for which some sort of a bracket will have to be made to fasten it in place conveniently. Drill a hole through the baseboard to allow a beam of light to pass to the reflector and hence through the lens.

Some may want to use lower voltage for the signal, but 12 or 16 volts makes it more sensitive and positive because higher voltage breaks through any dirt or other surface resistance of the tracks.



BUILDING A CABOOSE

Step-by-Step Construction Methods Following CNJ Prototype.

TO THE uninitiated let it be explained that a caboose is attached to the rear of freight trains for the accommodation of conductors and trainmen and is used as office and quarters by them while the train is in transit. It is also used for carrying a variety of stores, tools, etc., that are required. Being at the end of the train, as a rule, it should carry marker lamps or flags.

Full size templates and drawings for the three popular gauges can be found on the following pages, and the description will take the differences into consideration. The photo at the lower right shows the O gauge caboose of J. Harold Geissel, Paoli, Pa., and the step by step construction photos are of an HO caboose that I built from his drawings. Before you begin on this project it will help tremendously if you look over these drawings and photos.

Except for the floor and the center beam, the entire caboose is built up of flat sheet stock. This can be either brass or tinned sheet iron. The sheet iron, or "shiny tin," as it is sometimes called, will hold the paint better, but is more likely to rust if it is not painted in a moderate length of time. In either case the material should be .012" thick or thereabouts. Your local tin or brass shop will be able to supply you with this material or, as a last resort, cut up and use a 5-gallon oil can of the lighter variety.

Lay the sides and the ends of the caboose out on a piece of flat stock, locating the windows in doing so. The measurements can be traced from the full size templates, or they can be "picked off" with a pair of dividers and transferred to the sheet stock. Cut the pieces to size with tin snips and drill out the window and door openings. Use the largest drill possible in order to remove most of the waste metal. File the window openings to shape using the methods shown in the photograph. This allows you to see the scribed line at all times during the filing operation. A very accurate filing job can be done in this way. Be sure that you have filed to the window opening rather than the smaller sash

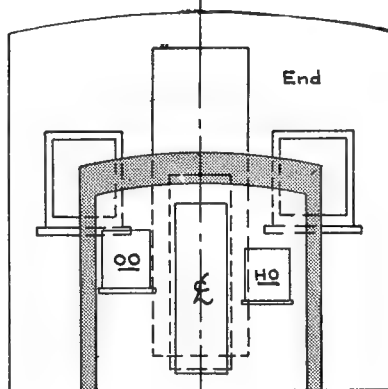
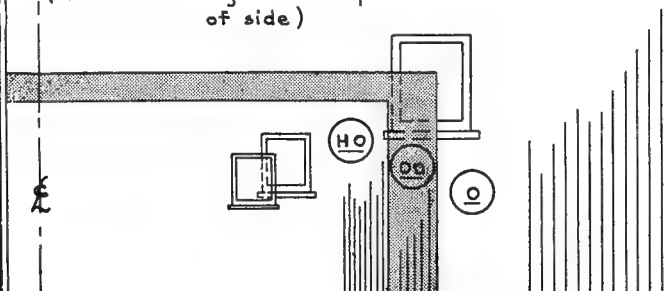
opening, which, incidentally, is a separate piece of metal as shown on the drawing.

The sash pieces just mentioned should be made next. Cut out four square pieces and bend up the corners shown shaded, and solder these pieces to the inside of the caboose sides. The four bent-up ears will be used as a means of holding the window material in place after the caboose is painted. With this in mind, do not bend the ears over completely at this time. Lay out the sash openings and drill and file these out to shape. One of the photographs shows these for your understanding. A piece of metal can be cut to cover the door and windows of the end. With this piece in place the door effect is as if it were solid. In order to panel the door, two openings should be filed in the door and another piece of metal soldered to the back of it. One of the photos shows how these pieces are arranged and soldered in place. Bend over the corners for the window material in the same manner as used for the sides. Next, lay out and scribe the body parts rather deeply, using an adjustable square to insure squareness. Go over the surfaces lightly with a fine-cut file to remove any of the burs that were kicked up in the process.

The sides and ends are now soldered together, using the same method as shown in the photograph of the cupola assembly. In joining these parts together have the ends overlap the sides. Next cut two pieces of square brass to act as stiffeners. These are fastened along the upper



Side of Caboose Body
(Window arrangement duplicated on other half
of side)



FULL SIZE TEMPLATES FOR O, OO, AND HO GAUGES.



HO



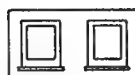
OO



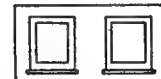
Make
2
of each



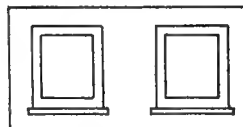
HO



OO



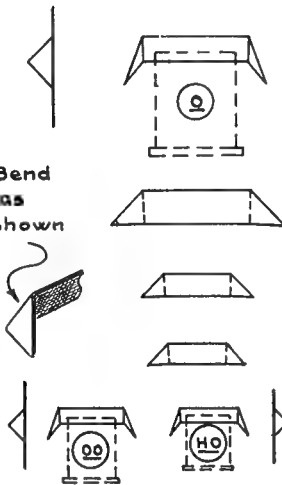
Make
2
of each



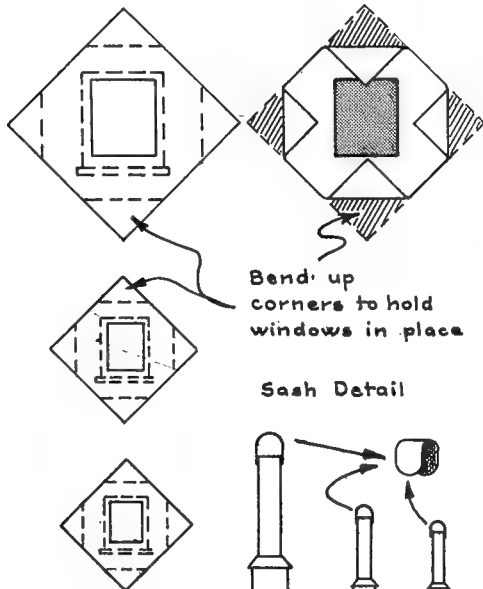
012"
sheet stock

Cupola Side
and End

Bend
as
shown

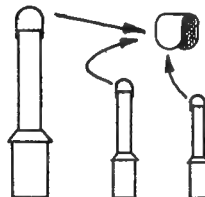


Window Shade



Bend up
corners to hold
windows in place

Sash Detail



Chimney

End Platform

Bend flap down



Flap

Make
2



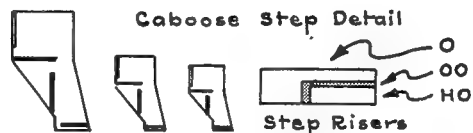
Flap

End Platform



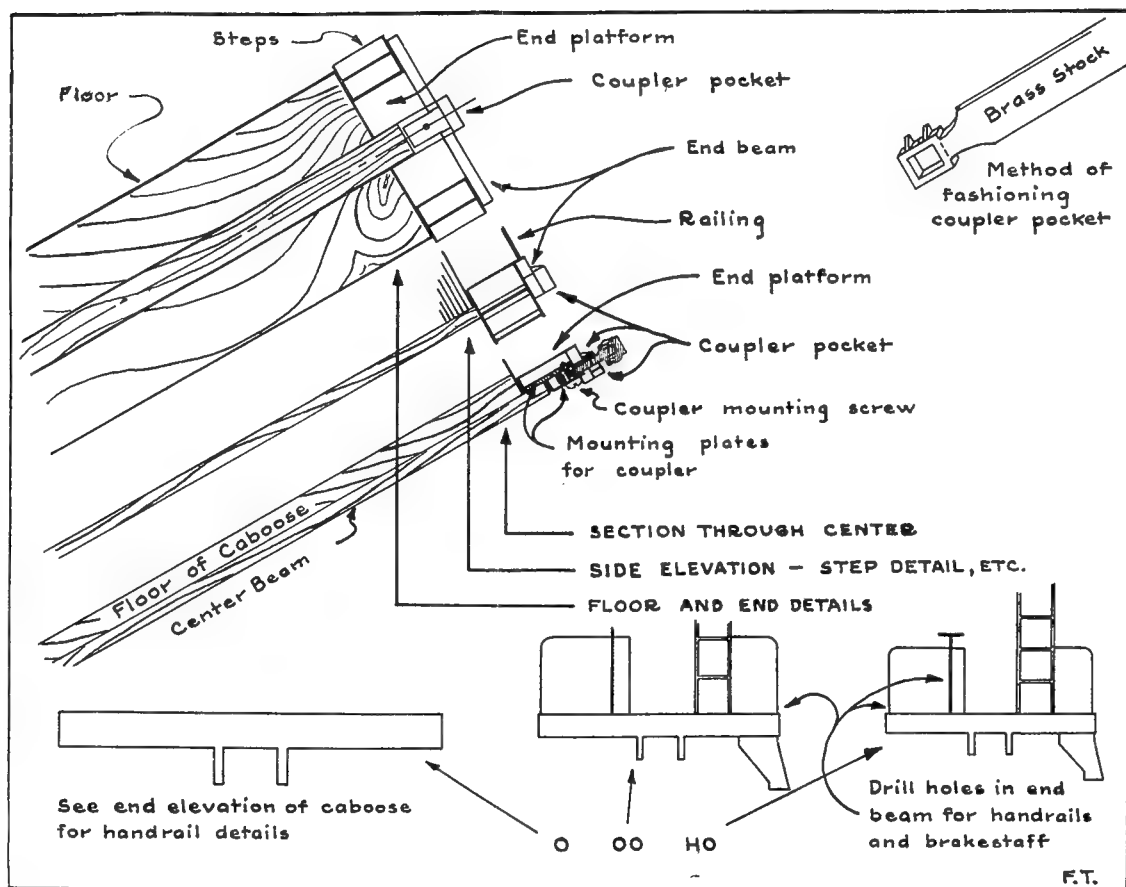
Hood for Chimney

Caboose Step Detail



Step Risers

C.N.J. CABOOSE



edge on the inside of the body. The square brass is commonly used for third rail purposes. The roof material is prepared next. For the O gauge model the over all length can be measured directly from the full size drawing. For HO the roof should be 107 mm. long and it should measure 124 mm. for the OO gauge model. The width of the roof is made oversize and filed to a finish line after it is attached to the body. The curve of the roof should coincide with the top edge of the end. Bend it over a piece of pipe to obtain this. The photograph shows how the body and the roof are held while soldering them together.

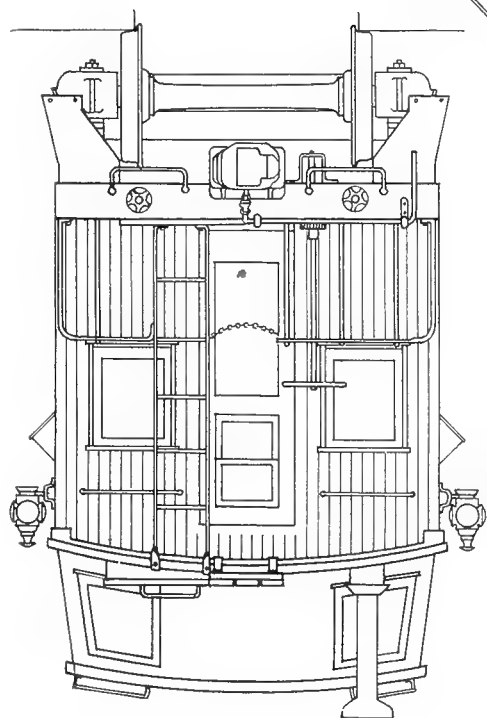
The drawing shows a strip of wood that is fastened to the side of the car and butted up against the lower edge of the roof. This is called a fascia and is modeled by soldering a strip of brass in place as shown. This strip should be carried completely around the four edges of the roof. With this in place the roof edges can be filed down to within a hair of the fascia. The roof should overhang slightly. Clean up the excess solder, using a wood chisel or coarse and fine files.

The over all dimensions of the cupola can be taken from the full size template and used in laying out the cupola location of the roof. As in

the case of the sash, a drill is used to remove most of the excess metal and the hole then filed to size.

The roof on the model exemplifies that used on the prototype, which is of steel construction. Actually the plates that make up the roof are formed to interlock with each other, and these joints are simulated on the model by soldering pieces of square brass wire laterally across the roof. Divide the roof section between the cupola and the end of the roof into five equal parts and scribe lines thereon. Locate and solder the aforementioned brass wire to the roof at these locations. See photo. The OO and HO models can appropriately use $\frac{1}{32}$ " square brass wire which is ordinarily sold for third rail purposes, and $\frac{1}{32}$ " x $\frac{1}{16}$ " brass stock can be used on the O gauge model. Referring to the two smaller gauges again, these $\frac{1}{32}$ " square pieces should be filed to half their thickness after they are soldered in place.

Lay out and drill the handrail holes. The added details will prevent this being done afterwards. Cut four pieces of square brass wire and solder them in place directly below the window openings for the window sills. Locate them in exactly the right way before doing any soldering, be-

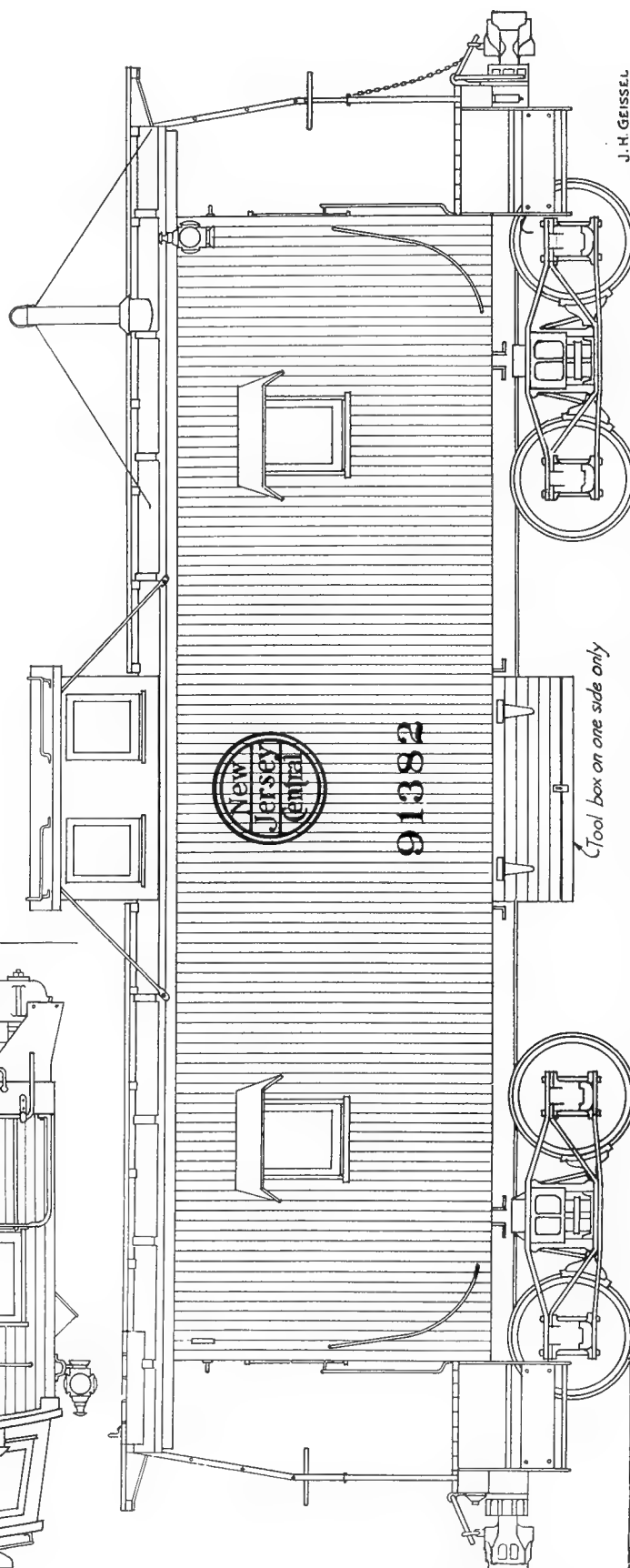


1/4" SCALE

CNJ Caboose Plans

Drawn by J. H. Geissel.

These are prototype plans and have not been altered in any way for model use. They can be rescaled for any gauge by taking off dimensions with 1/4" scale rule and laying out with a scale rule of the gauge being used.



J. H. GEISSEL



cause it is rather difficult to move them to the right place after they once have been soldered elsewhere. Make four window shades and bend them as shown. Use the same methods as for the window sills. Clean off all excess solder and reopen the scribe marks with a scriber if they have been filled in during the soldering process.

Let it be mentioned that all of the materials used on the model are .012" stock unless specifically stated otherwise.

According to correspondence, quite a few modelers have trouble soldering locomotive cabs, tenders, and other metal bodies together squarely. In putting the cupola for this caboose together a picture was taken of the operation in the hope that this group of modelers would have an easier time of it in the future. Notice that a block of wood is nailed to the bench top for use in butting the work up against it and is also used as a means of holding the work square while soldering. Take advantage of the tools you have on hand; for example, the scriber can be used as a hold-down

almost indispensable in making good models. The set contains a dozen different shapes, and with these you will be prepared to turn out good work. The right kind of tools is half the battle and, as these are not expensive, you should consider their purchase. Press the cupola in place and solder it to the inside of the roof in one place. This will allow you to shift the cupola slightly to correct any off-squareness before soldering the unit permanently in place.

The running boards are to be installed next, and these can be made up in several different ways. A single piece of metal can be scribed rather deeply to give the effect of the three boards used, or three separate pieces of metal can be cut and soldered to the support with a slight space between each strip. You can solder the running boards directly to the ridge on the roof, or separate supports can be used as shown on the full size drawing. These alternatives can also be applied to the extra walks that are found near the top of the ladder. Whichever method



tool as well. Why burn your fingers? Before soldering the cupola together, the window openings should be laid out and filed to shape. The sash openings are not filed out until after the cupola is assembled, as this unit is easier to hold than the separate pieces would be when filing. Form the roof before soldering it in place. It can also be cut slightly larger and filed to size after installation. The material is so thin that these filing operations are really no trick at all, so don't let the term scare you.

Refer to the photographs again. One of them shows the filing operation on the cupola. This method of filing work is accepted by tool and die makers as the most accurate way of filing to a scribed line. The line is constantly in view during the filing operation, which would not be the case if the work were clamped in a vise in the conventional manner, and the file brought to bear down upon it. The file itself would obstruct your view and, as we all know, three or four swipes too many will ruin the work. It might be mentioned that a set of Nicholson pattern files is

you use, be sure that the surface of these walks is parallel with that of the floor of the car instead of following the contour of the roof. The walk braces, which are made up of two pieces of wire, can be added at this time. These can be seen next to the top of the ladder.

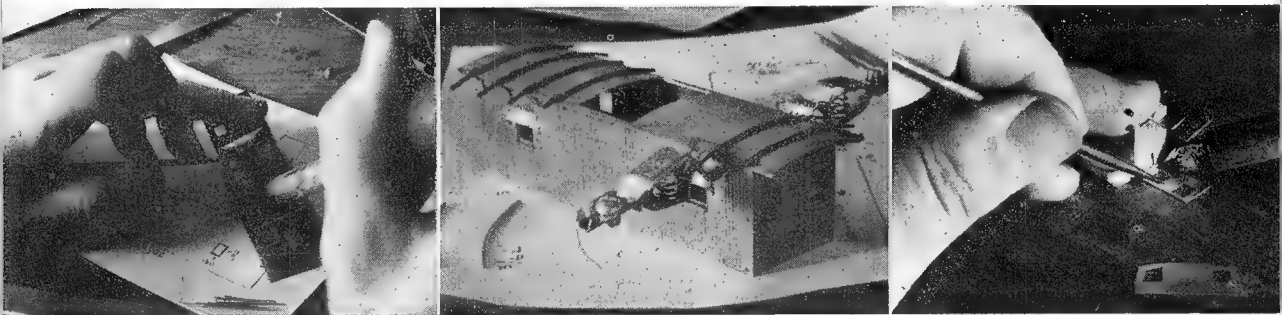
Use the full size template in laying out the end platform. One of these will be necessary for each end of the car. After cutting to size, scribe the lines that represent the planking on the platform. Bend on the dotted line to form an angle, as shown on the drawing. The angle or bend is designed so that, when placed flush with the bottom of the body, the platform will be located at the correct height. Clamp a platform piece to the body as just mentioned, making sure that it is centered from each side, and then solder it in place. Small battery clamps, such as shown in the photograph, are exceptionally helpful for this kind of assembly. The end beams are made up of $\frac{1}{8}$ " thick brass for the O gauge model and $\frac{1}{16}$ " thick for the OO and HO sizes. Lay out the pieces from the template and file to size. Solder

the end beams to the bottom of the platform, using the battery clamps once more in the process. Be very meticulous in locating this beam before soldering it, as much depends on the spacing and the squareness of this part. For example, if the beam is not parallel with the end, this would cause one of the steps to be narrower than its mate on the other side of the car, and the hand rails would be out of kilter, a very undesirable condition because it would be glaringly apparent.

Making four complete steps by hand seems like a tremendous job, but this actually is not the case. Lay out and file to shape only one step side. Use the full size template in doing this. Next solder four pieces of material together, the top piece being the step part. After these four pieces are soldered together, cut and file the lower three pieces to correspond to the top piece. After these parts are filed to the exact shape required they can be unsoldered and one of them used as a guide in making the balance. In this way the

risers directly below the platform. Lightly solder this piece to one side, make any adjustments necessary, and then permanently solder it to the other side. Then go back to the first side and solder that permanently. Next, put in the center tread, using the same methods. Do all soldering from the bottom and inside, to save cleaning up on the various parts. The lower riser can be installed after this, and that followed up with the bottom tread, to complete the steps. The four steps are all made in the same way, and the only thing to watch out for is the heat. Do not hold your soldering iron in one place too long.

The coupler pocket is shaped from a piece of $\frac{1}{16}$ " thick brass stock for the OO and HO models, and from $\frac{1}{8}$ " stock for the O gauge version. The sketch shows how a part as small as this can be made up very easily. All of the detail is created before the part is finally cut away from the stock. This procedure gives you something to hold the piece with in the vise, and if the "handle" is nicked or chewed up because of this, the piece to



eight necessary pieces can be made exactly the same shape in a minimum of laying-out time. Now solder four of these sides to the end of the car proper and the other four to the inside of the end beams. Refer to the photographs, which show a good method of holding these parts while soldering. You might wonder why the steps are not made up on the bench and then attached to the car, but it can readily be seen that if the side pieces are fastened permanently in place the tread and risers can be cut to fit between and the whole assembly will look right. If the steps were made on the bench before installation it would be quite difficult to hold the various parts (including the two side pieces) while soldering, and after the parts were soldered together it might be found that the step assembly was a bit too wide or too narrow for the space, and this would be rather hard to correct. These splurges of reasoning are made because there are quite a few fellows who want to know why and what for.

The steps and risers are separate pieces of metal and are best installed by starting with the

be used, at least, is not spoiled. Solder the coupler pockets to the end beam as shown. The half page of drawings shows the assembly of various parts which go to make up the caboose at this location. Notice that a piece of $\frac{1}{16}$ " thick brass stock is fitted between the end beam and the car end and is soldered flush with the bottom of the car. This will form a partial means of support for the couplers and is thick enough to tap if a machine screw is to be used as a coupler king pin. The other part of the coupler support assembly is shown as a thin piece of sheet stock. The only reason this angle is used is for the purpose of securing the head of the machine screw and, in a small way, also to support the coupler shank. The hole in this angle should be large enough so that the king pin can pass through it freely, which, incidentally, allows it to be drawn down tightly. If a machine screw is not used as a king pin, an ordinary pin can be substituted. The head of this pin can be soldered to the angle just as mentioned, and the $\frac{1}{16}$ " plate that was previously tapped can be drilled for the pin.

When mounting the coupler be sure the knuckle is on the left side as you look at it. A good way to remember just which way a coupler is installed is to consider it as a right hand, the knuckle being the fingers, so that you can fit your right hand into it and shake hands, as it were. A number of fellows get these on upside down and perhaps this kink will help.

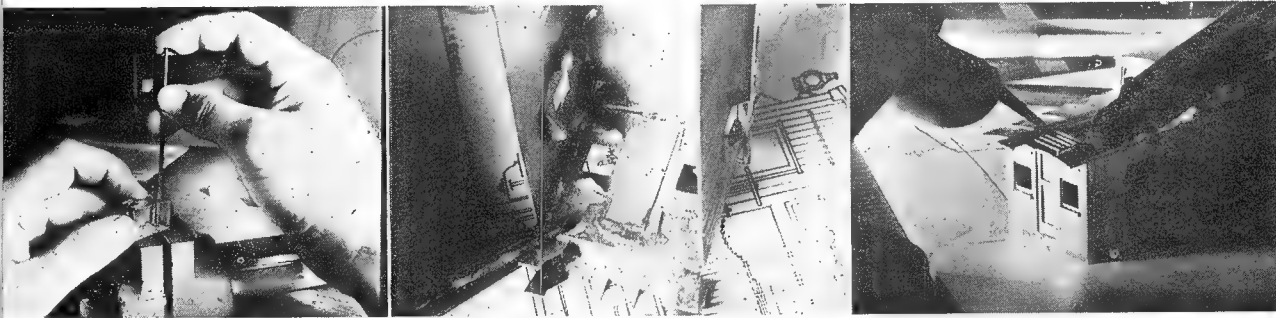
The hand rails are bent to shape and soldered in place, taking advantage of the inside to do the soldering, where possible. In order to obtain an equal spacing between the side of the car and the hand rail, a piece of cardboard can be used. The hand rail is bent to shape and slipped into the holes provided, with the cardboard spacing it out from the body, and the assembly is soldered in place. This trick will help you to make the model look neater and more workmanlike than would be possible if the spacer were not used.

Due to the fact that the roof does not completely cover the platform, a bend will be put in the ladder to follow the prototype. The brake

from the opposite rail and carry it to a mounted lamp in the body of the caboose. In case the caboose is to operate over a three-rail system, the insulating of trucks from each other need not be taken into consideration. Instead, a third rail shoe should be mounted at the side to pick up the power.

No mention will be made concerning the mounting of the lamp, as a standard lamp socket screwed to the floor with the proper electrical connections is all that is necessary.

The last thing to make is the chimney. This can be turned on a lathe to the size shown, or if necessary a plain piece of round rod can be used. The hood for the chimney is cut to the shape of the template and then soldered in place. Drill a hole through the chimney, just at the base of the hood, to allow the bracing wire to pass through. Next drill a hole in the roof to accommodate the chimney. Press the turning into the hole and solder in place from the inside. Do likewise to the wire bracing.



wheel and staff can be put on next. As shown in the drawings, the various holes for these wires in the end beam can be drilled before the beam is soldered to the platform.

Fit a wood floor to the car, filing a notch in the edge of it here and there so that it will clear the obstructions made by the soldering of the hand rails to the inside of the car. A center beam should also be made of wood, principally to insulate the trucks from each other. This is suggested to allow each truck to pick up current

Clean the car with a good strong washing solution to remove any flux and to prepare for the painting. Mount the trucks after the car is painted and lettered. The arch bar trucks can be purchased from any number of reputable manufacturers. The couplers and brake wheels can also be purchased from the same source.

By gosh, we almost forgot the tool box. Well, this is made up of a block of wood that is appropriately scribed, and small pieces of cardboard pasted to it will do for the hinges.

A TIMBER TRETTLE

IT HAS often been said that a model railroad without scenery looks bare and unreal. Most of us realize the wisdom in these words, and the usual expedient is to build mountains and tunnels as an effective background for our locomotives and cars. The mountains and tunnels are easy to construct, and the "artistic" effects are usually handled in grand style by the average amateur. Considering the results obtained, the labor involved is well spent.

For a real thrill one should go a step farther and include a timber trestle in the layout. The difference in sound as your train rumbles over a trestle and the railroadiness of it certainly packs a big wallop. The trestle described in this chapter is designed for a double track, and you can well imagine the effectiveness of two trains passing each other on it.

Timber trestles are bridges having one or more spans that are supported by bents. A "bent" is made up of timber framework and is designed to act as a pier for the support of a vertical load. Four or more upright posts are used in the construction, and these are transversely secured at the top and bottom. The vertical posts of each bent are located so as to take the load, and these are called "plumb posts." For further stability a "batter" post is located near each end of the bent, and the tops of these are tilted toward the center of the assembly. The batter may vary between 1½" and 3" per foot. In addition to the

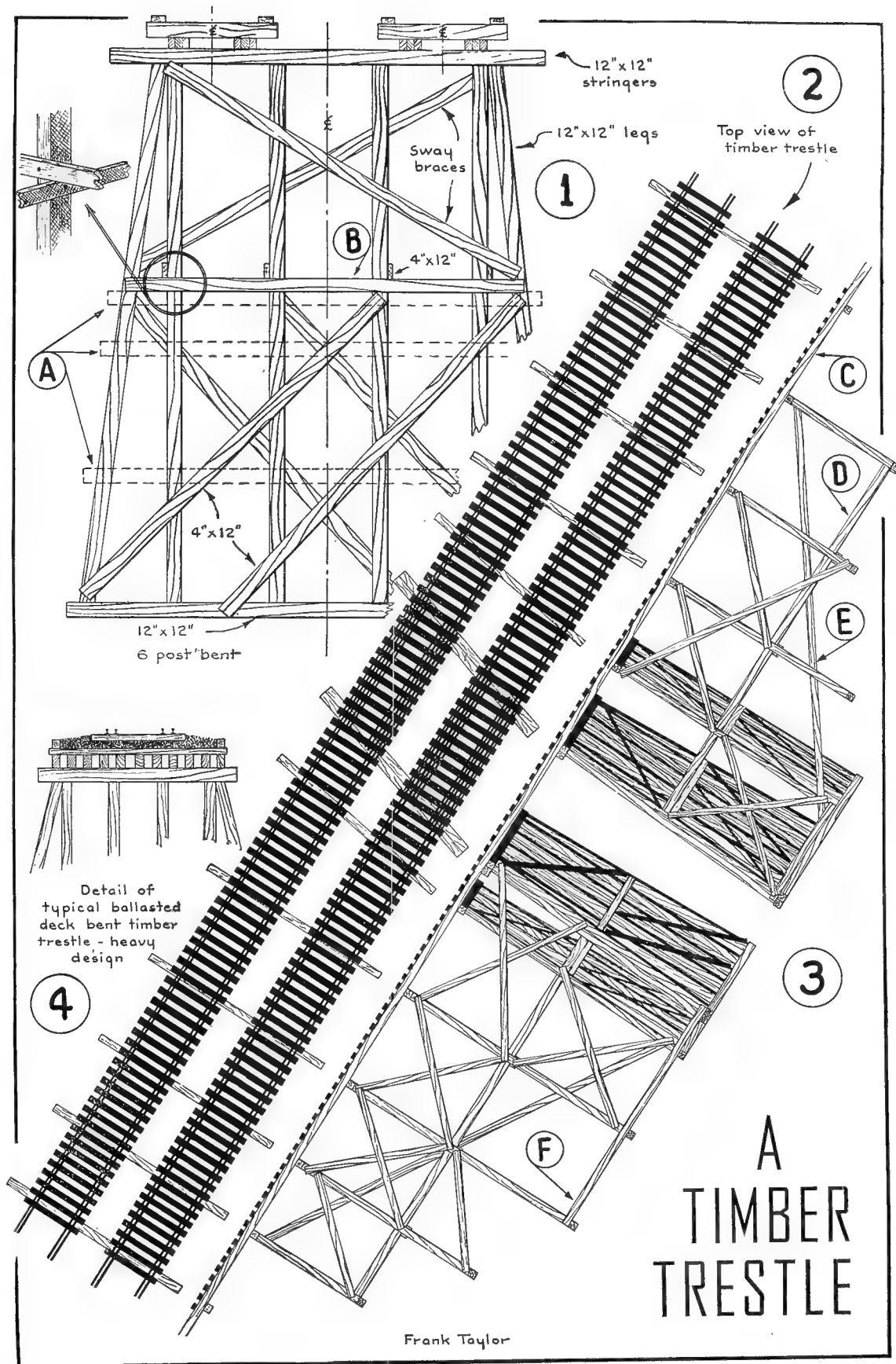


This photo shows one of the timber bents and the details of fastening the various parts of the trestle together.

batter posts, a number of sway braces are used for further strengthening. These are usually planks, and are placed diagonally across the front, as shown in the sketch on the opposite page.

As a rule the sway braces and other bracing timbers are installed so that a uniform design is carried out, but this does not seem to apply in this case, as you can see by examining the drawing and photographs of the prototype. The builders of this trestle have varied the longitudinal side bracings to form a rather interesting pattern, which proves that a person can take some liberties in this respect when building the model.

The material necessary to build the timber trestle pictured can be obtained from your local hobby shop, or anyone with a circular saw would be able to rip the necessary sizes for you. Several model railroad manufacturers also handle the various sizes of wood. The drawing on page 47 is about half size for HO or OO gauge, and all of the dimensions should be multiplied by four to build an O gauge trestle. You might find it nec-





The above timber trestle was scaled down for use with this article.

essary to change the track centers in order that they will conform to the rest of your layout; otherwise, no dimensions need be changed unless you feel so inclined. After all, there is no definite length or height that a trestle must be.

The first step is to determine the amount of materials needed, and the best procedure is to begin with the bents. All of the timbers that go to make up these bents, with the exception of the sway braces, can be cut $\frac{1}{4}$ " square for the O gauge model and $\frac{1}{8}$ " square for the HO or OO gauge model. Determine the number of strips necessary to make each bent, and after adding up to arrive at the total, add 10 per cent to allow for waste in cutting. Refer to C, D, E, and F in Fig. 3. These strips are cut $\frac{1}{8}$ " x $\frac{1}{4}$ " for the O gauge and about half that size for the smaller gauge models. The various photographs will also show you how many E's are used and other information that does not show in the drawing.

The trestle being discussed is subjected to light duty on a branch line, and, therefore, parts such as C are considerably lighter than would be the case had the structure been designed for heavier traffic. If you are going to install this trestle on your main line, it is suggested that the timbers referred to as C be enlarged to represent 8" x 16" timbers. Three or four of these, depending upon the amount and kind of traffic the bridge is to bear, can be located side by side underneath each rail. These suggestions are for

outward appearance only. It has been found that if all the material used were only half as strong, the structure would still be ample to support the heaviest of model railroad equipment in motion. However, realism is what we are striving for because it has so much to do with our satisfaction concerning the hobby. We like scale equipment for this reason, and the structures and accessories should also be to scale.

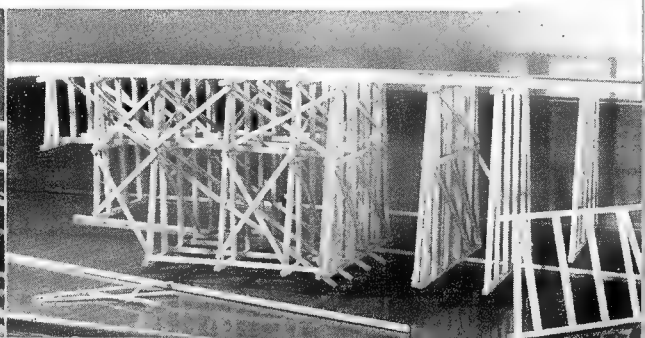
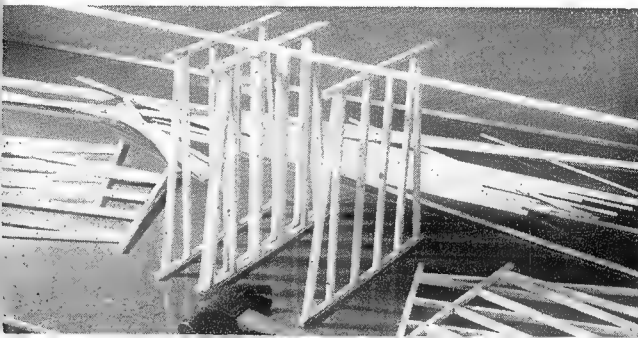
Before actual construction starts you should decide just

where the trestle will be used on your layout. If it is to be installed on a line that is to be built, you can design the supporting table to allow for it. However, if it is to be installed on a main line that is already in operation, it will be necessary to undermine the track, so to speak, and suspend operations for a night or two. To cut away part of the table and install a ravine or cut seems like a big job, but the renovation progresses very satisfactorily once it is started. Having some of your scenery below table level will add to the scenic effect, too.

The bents can be varied in number, thus decreasing the length of the trestle, or lengthening it, for that matter, depending upon your inspiration and space available. Referring to Fig. 1 you will notice that the bents are all made the same with the exception that some are shorter than others. The dotted lines, A, show how the timber used for the base can be relocated to suit the terrain.

The first operation is to assemble the bents, and an easy way to duplicate the assembly is to draw a bent, full size, on a piece of yellow wrapping paper and then assemble the various wood parts directly on this drawing. Obtain some small bank pins for fastening the various parts together in addition to the gluing of the job. The bank pins referred to are about $\frac{7}{16}$ " long and can be ordered from a stationery store. The size of these pins makes them very useful for other

Left: One of the first steps of assembly. Right: Partially finished trestle held together with glue and pins.



modelmaking purposes, too. The glue or cement used is the kind that model airplane fellows use. It makes a strong joint and is quick drying. Check the various bents for squareness before the glue dries.

Put on all the sway braces shown in Fig. 1 while the bents are lying flat on the wood table, because some difficulty will be experienced if you try to glue and pin these in place after the structure begins to take form. It will not be necessary to pin the sway brace to each timber that it comes in contact with. In fact, some of the braces can be held in place with glue alone.

The stringers are cut the full length of the trestle. Lay out the positions of the bents on the two outside stringers and begin to assemble the



The finished timber trestle.

structure as shown in the lower left photograph on page 48. As mentioned before, the stringers should be located directly underneath the rails, and therefore you should locate the positions of the rails on the top of the bents and from these markings determine the positions of the stringers. Glue and pin each joint. For additional strength, glue the stringers to each other as there are three of them lying on edge and side beneath each rail.

The design of the trestle allows a narrow roadway to pass beneath it. Actually, this road is 16 ft. wide, a little longer span than any of the others. For this reason, you should place two extra stringers on each side of each rail and long enough to span this gap. Reference to Fig. 2 will show the top view of these extra stringers in place. Also notice that two bents are used side by side on each side of this highway span. The drawing shows these bents just mentioned to be slightly askew. This arrangement was taken from the original, which was built that way because the highway passed beneath the tracks on an angle. This angularity in the model has a distinct advantage, one that you will appreciate after the trestle is built, and especially as no extra work is involved to accomplish this effect.

Next, refer to detail D; these pieces are $\frac{3}{32}$ " x $\frac{1}{4}$ " for the O gauge model and $\frac{1}{16}$ " for the HO and OO models. Three of them are put in place on each side of the span as shown, and it is sug-

gested that these be glued and pinned, especially at the ends. After the pin is driven halfway home you can clip the pin off and press in the remainder. Cutting the pin in half in this manner will prevent the point from coming through the opposite surface.

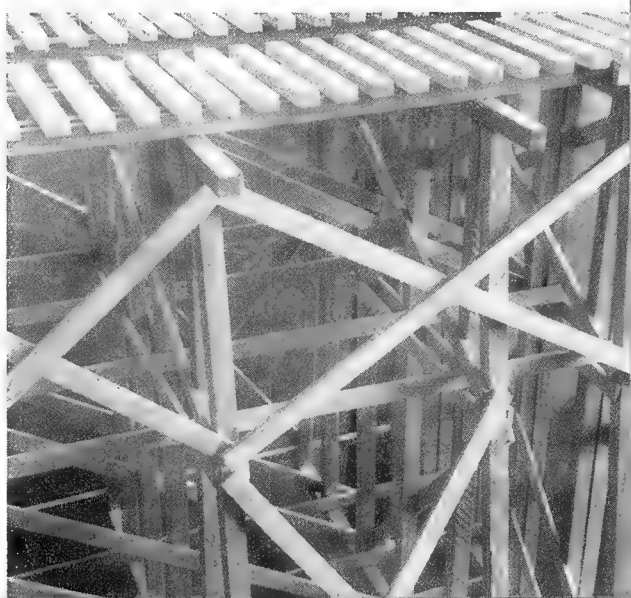
The braces referred to as E are installed next. Four of these are used on each side of the main span as shown. You will notice that they are fastened to the opposite side of the timbers from the braces, D. These are also glued and pinned wherever you find it practical to do so. The braces are glued in position as shown, and six of these are used on each side of the span.

The outside bracing that runs diagonally from one bent to the other is made of the same stock as was used for D, E, and F. The drawings and the photographs will guide you as to where these should be located.

With the exception of the ties and piles on which to mount the trestle, the project is practically complete. The ties can be glued in place. These should be correct scale thickness because they are entirely exposed.

The bridge being modeled is supported on what are called "mud sills"; that is, the sections of timber that form the base of the bents are of sufficient area to support their share of the load without being disturbed, which means that you can form plaster, dirt, rock, or whatever material you use for surfacing hills and ravines, right up to and around the base of each bent. A set of steps can be built up to support the shorter bents of the structure, and any scrap lumber that you have around will suffice for this purpose. One of these steps or supports should be built up underneath each of the shorter bents to which the structure can be glued and pinned.

Closeup of model, showing braces and ties in place.





One of the new B&O Class M-53 cars.

WAGON TOP BOX CAR

How to Construct the Baltimore & Ohio All Steel Class M-53 Freight Car.

CONSIDERABLE model builder interest has been shown in the box cars built by the B&O in the thirties. They are a radical departure from the conventional car design, the superstructure being formed of the one-piece combination side post and roof carline, extending up one side of the car, across the top and down the other side. This makes the model rather easy to build and when finished it is sure to excite comment.

The body is formed around a block of wood. This is shown in one of the photographs. A solid piece of pine or a builtup block will do the trick. The size of the block is determined by scaling the side and end elevations, which are drawn $\frac{1}{8}$ " to the foot. The car can be built to any of the popular scales, using the construction methods outlined. The materials used for the body proper are also the same for the various gauges. Use brass sheet stock about .010" or .012" thick for the sides, floor, ends, roof walk, destination boards, underframe, etc. The ribs, of course, will vary. For HO use $\frac{1}{32}$ " square, OO $\frac{3}{64}$ " and O gauge $\frac{1}{16}$ ". The doors will also vary in thickness, but as these are built up sandwich style, special material will not be necessary. With this information in mind, buy sufficient flat and square brass stock for the model. The square stock is sold by manufacturers and dealers for third rail purposes and the flat stock can be obtained from a local brass company.

Cut the brass sheet about $\frac{1}{16}$ " longer than the forming block to allow for fitting, mainly because the ends fit between the sides. Line the material up with the bottom of the block and then wrap it up over the top and down the other side. This first attempt at forming the metal will indicate where the bends are located. As the metal has a

certain amount of spring, it will be necessary to depend upon some other means of forming to overcome this characteristic in order to obtain a true shape. The old standby is to develop the bends by forming around a round rod slightly smaller than the curve desired to compensate for the springing back of the material. Use the block to check up on the accuracy of your work. The metal should tend to hug the forming block without any persuasion on your part.

To make the ends, lay a piece of flat stock on the bench; press the end of the forming block against it and scribe around the block; then cut to the scribed lines. File off any irregularities. Then slip the formed piece and the ends over the block and solder the parts together. Be sure that the ends are pressed against the block before soldering. Although not in order, this should be remembered: The car end is not made flush with the bottom of the sides. Look at the drawing. Things like this are easily overlooked. Incidentally, the bottom of the ends determines the location of the bottom of the door opening. File the sides flush with the ends.

Lay out the door opening and the location of the braces. A combination square can be used to good advantage in laying out the latter. Set the square, measuring from the end of the car, and scribe the sides and roof, using the end of the tool as a guide. Reset the square for the next line, and so on. The door opening can be laid out by using the same tool, with the bottom of the car side as the working edge.

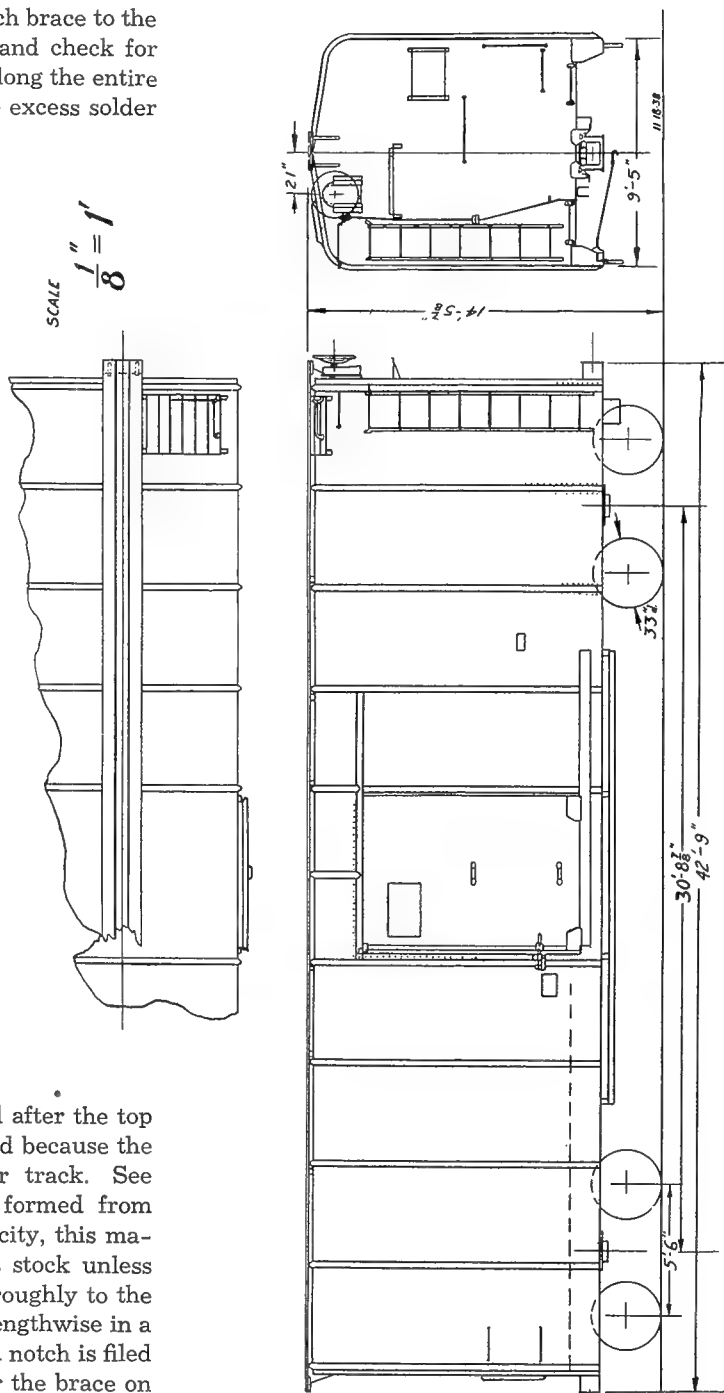
The braces should be soldered to the sides and roof before the door opening is cut out to take advantage of the added strength. Before they are applied, these braces are formed in the same

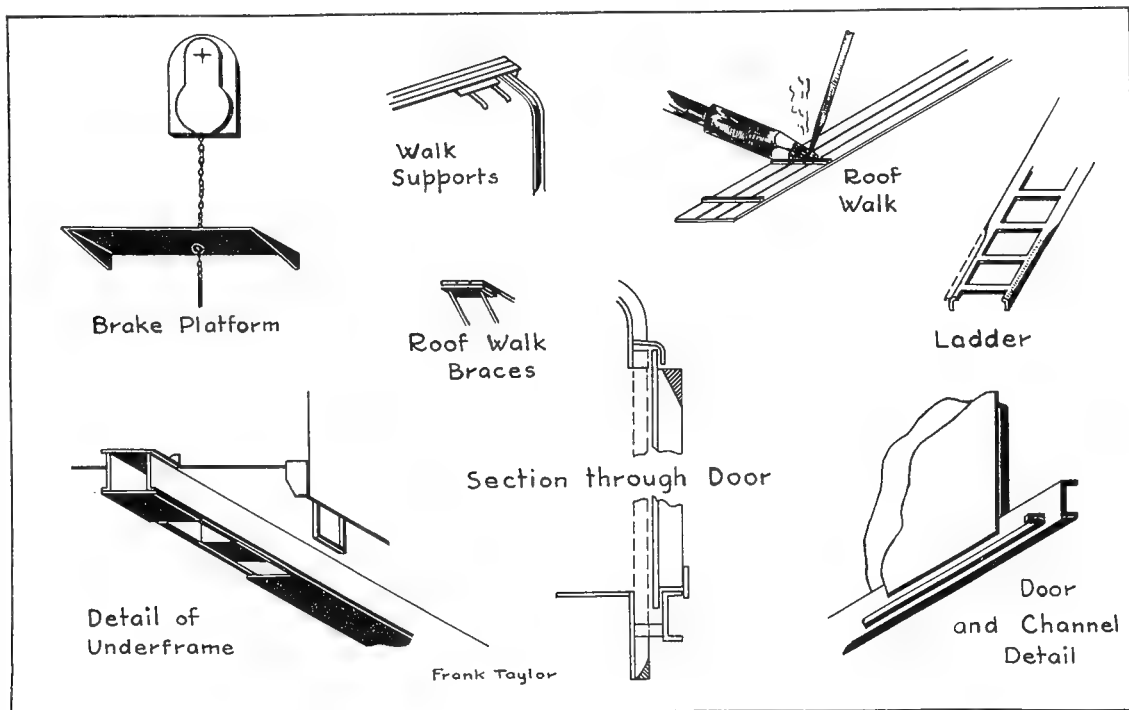
manner as was the roof and sides sheet. The block should be carefully removed from the car for this purpose. Lightly solder each brace to the roof and the bottom of the sides and check for squareness before flowing solder along the entire length of the braces. Clean off the excess solder with a file or a wood chisel. As the braces are not square on the prototype, a forming scraper will need to be made so that the braces can be given the correct contour. A piece of $\frac{1}{8}$ " round iron rod is filed to look like the business end of a screwdriver. A notch is carefully filed in this with a small round file. See the photo. Hold the tool as you would a pencil and draw it toward you. The braces will take the shape of the notch under this treatment, so take care in filing the notch. One almost has to rely on this method if the braces are to be given identical contours. Filing would be a harder way of doing the same thing. Drill a series of holes around the inside of the door opening lines, break out the piece and file to the lines. The forming block can be used as a support for the side when drilling through it. Just slip in part of the block to avoid trouble in getting it out again. I wrote up a good method of filing out openings in the small station chapter. Refer to this.

The brace on the roof directly over the doors will be forgotten 'til after the top and bottom door tracks are installed because the brace butts against the top door track. See drawing. The top door track is formed from .012" flat brass stock. (For simplicity, this material will be referred to as brass stock unless otherwise specified.) Cut a piece roughly to the length and width desired, bend it lengthwise in a vise, and then trim it with a file. A notch is filed in this piece to permit it to fit over the brace on the right side of the door opening. Solder in place as shown in the section-through-the-door perspective. A square filler strip will also be noticed directly beneath the top door track. This fits between the braces on the left and right sides of the door opening and permits the door to slide without brace interference. Enough space should be allowed between the door track and the

spacer for the back half or inside layer of the door. As this will be made of brass stock, a scrap piece of it can be used between the track and the spacer when soldering the last two in place.

The bottom door track is made from channel iron and, in our case, from sheet brass bent to



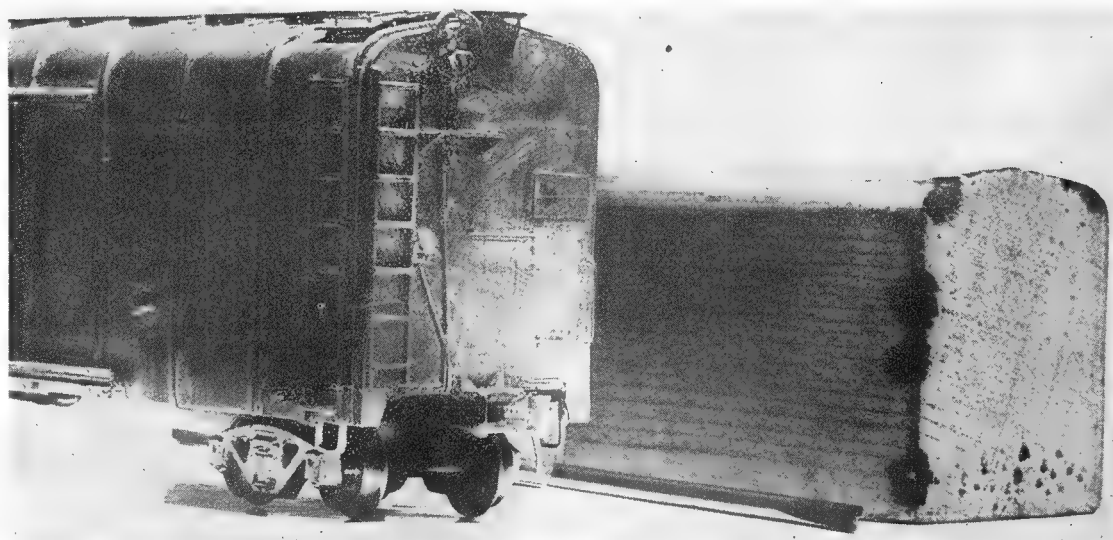


Construction details.

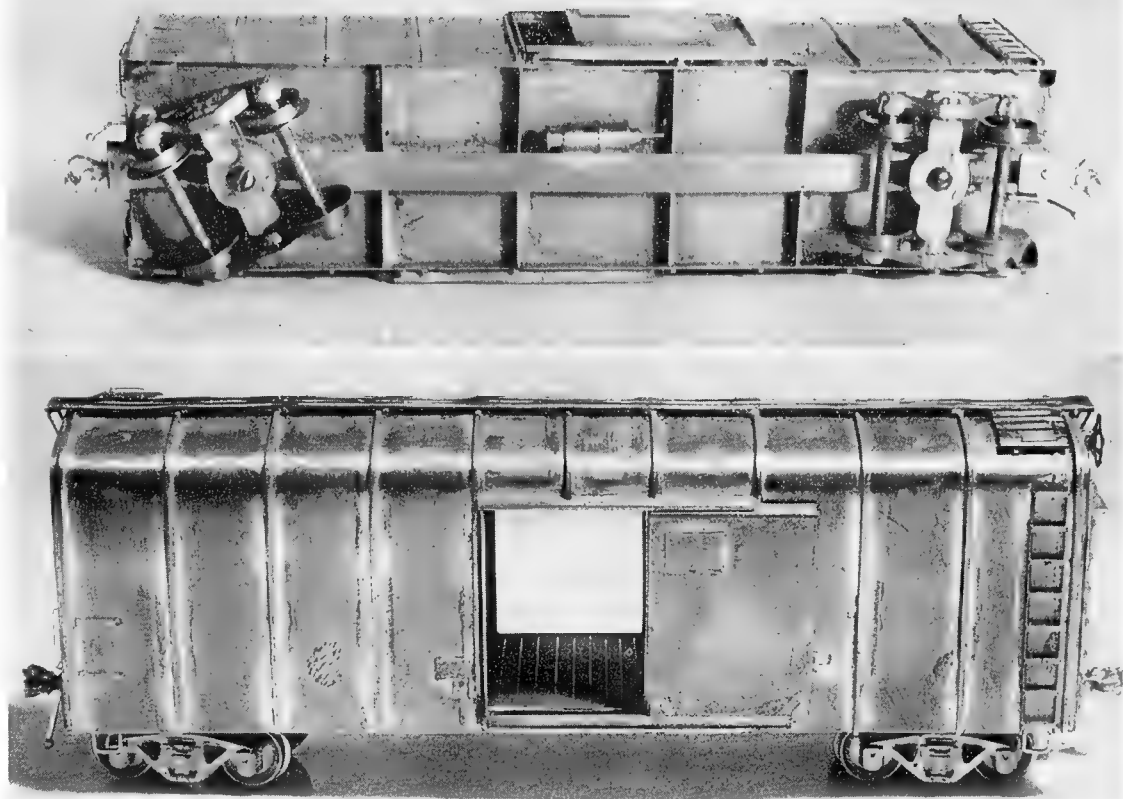
shape. The first step in forming the channel is to bend an angle in the vise. The next bend will determine the width of the channel, which will vary depending upon the scale. For HO a piece of $\frac{1}{16}$ " thick material is used as a means of spacing the bends. O gauge requires a piece of $\frac{1}{8}$ " material for the form. The angle should be soldered to this material and the second bend made. Unsolder and file the two lips of the channel to the correct size. The door track brackets are

formed of the same material as was used for the braces on the body. These are soldered to the back of the channel and near the bottom. See perspective. Solder the channels to the side braces in the position shown. Do the soldering from the bottom of the channel rather than from the top, so as to allow the door to slide freely in a solder-free track.

A piece of brass stock is cut to the exact width of the door and long enough to fit behind the



Three-quarters view of the model wagon top box car. Note details on car. Forming tool and block are at right.



Bottom and side views of the unpainted model. Notice the scribing on the floor.

channel and upper door track. As mentioned before, the door is built up sandwich style. A frame of the same square stock used for the braces is soldered to the plate just prepared. Four pieces make up the frame for each door. The two side pieces of the frame are soldered flush with the sides of the plate and the top and bottom pieces of the frame are soldered in place with the door in the closed position so that they can be located to bear against the upper and lower tracks. A piece of brass stock is then cut to cover the frame and soldered in place. File off the shaded sections. This completes the sandwich. It is hoped this expression will help make things clear even though the sandwich could be put to better use just about now. The board on the door and the two shoes used to keep the door on the lower track are made of brass stock and soldered in place. The remaining roof braces can be soldered in position at this time. The door stop is soldered in place as shown. A strip of brass is soldered to the left hand side of the door opening for its full length. This strip is made flush with the inside surface of the car side and acts as a stop for the door when closed. It should be filed somewhat less than flush with the outside of the door.

The running boards are made up of brass stock and are soldered to the supports as shown. The scriber is a handy gadget for holding the parts while soldering. The spacing of the supports is transferred directly from the braces on the roof. Have the supports rest next to the braces on the side nearest the door. Do not clean off the solder as this can be used when sweat soldering the assembly to the roof. Apply plenty of flux and a hot iron. The end walks leading up to the running boards are applied after the supports are soldered to the roof. See perspective. Pins can be used for the running board supports.

Lay out the positions of the grab irons and drill holes to take the wire. Solder all grab irons from the inside and save cleaning up. A cardboard spacer placed between the grab iron and the car side will help to make them uniform.

This car uses the Ajax brake wheel. As these are available for the O gaugers and are a simple matter to pin on, the unit will be discussed for the smaller models. As shown in the perspective, the mounting plate is larger than the housing. Use brass stock for this purpose. The housing can be fashioned from $\frac{1}{16}$ " brass and soldered to the plate in the position shown. Drill a hole for the brake wheel shaft and solder the unit to the

car. Redrill the hole through the body. Buy a punched brake wheel and dish it out so that the hub of the wheel will be depressed. To do this, lay the wheel on a hole slightly smaller than the diameter of the wheel and depress the spokes and hub a little at a time, using a punch made of a wooden dowel. The end of the dowel should be rounded off for this purpose. Slip a pin through the wheel and mounting and solder to the inside of the car.

The brake platform is made of brass sheet stock and soldered to the end of the car. A hole is then drilled in the platform to allow a chain from the brake wheel housing to pass through. Small chain can be obtained from the five and dime. Solder one end to the housing, as shown. After passing the free end through the hole in the platform, solder it to a piece of round wire. The wire is soldered to the car end in one or two places and bent over at the bottom.

Available are ladders that are die cast, punched and built up. Punched ladders were used on the model. The sides were bent over to improve the appearance before soldering them to the body. Notice that the rungs of the ladders are on the same plane. Do not make the mistake of setting one ladder up high enough to spoil this effect. As the ladders on the side of the car usually have one more rung than those on the ends of the car, this can easily happen if you aren't "in the know."

Cut the floor from brass stock and fit it between the sides and ends. The planking can be simulated by scribing the material before soldering it in place. As mentioned before, the floor should line up with the bottom of the ends and the door opening.

This car has four plates instead of the usual poling pockets. These are soldered to each end at the lower corners. Run in a little solder from the back side for strength.

An air line can be seen alongside the ladder on the brake wheel end of the car. A piece of wire bent and soldered in place will suffice. The valve at the top of the wire can be modeled by piling up a blob of solder at this point and then carving it to shape with a small wood chisel.

The underframe is made up of brass stock. Cut two pieces to the correct length for the center beam. The angle at the bottom can be formed in

a vise. A piece of wood is then used as a spacer between the two formed pieces, and a plate, cut from brass stock, is soldered to the bottom at each end of the assembly. See the perspective. Now solder the unit to the floor of the car and lay out the truck centers and location of the braces. The plates used to strengthen the beam between the trucks, and the braces extending from the beam to the sides of the car, are also cut from sheet brass. The photos will help more than a hundred words of explanation on this.

Note that the beam is longer than the body. A plate is soldered to the top of this section of the beam at each end. These plates are bent and the ear on each side filed to shape before assembling. A piece of brass is soldered between the sides of the beam at each truck center. Then file smooth to form a bearing for the truck bolsters. Depending upon the trucks used, drill a hole in each of these bearings for the king pin. For two-rail operation, this king pin should be insulated if bakelite or fiber wheels are not used.

The air brake cylinder is fastened in place next. Be sure that it is installed on the same side of the car as the brake wheel.

Before putting on the couplers, the car is set on a track and checked for errors in height. The bottom of the side is 2'-6" above the top of the rail. Scale this down and check the model. If a variance is found it can be rectified by either filing the bolster to lower the car or by placing washers between the body and truck bolsters to raise the car.

The centers of the couplers are to be 3'-0" above the rail when installed. Measure the thickness of the coupler shank and determine the thickness of the spacers to be used above and below the shank. It would be well to solder these spacers to the upper and lower plates on the beam. Drill and tap holes for the couplers as shown. The holes in the coupler shanks should also be tapped for the mounting screws.

The installation of the air hoses completes the model except for the painting and lettering. Rather heavy wire is bent to shape and soldered to the bottom of the car. A blob of solder is formed on the free end of each hose to simulate the connectors.

Give the model a good bath to remove the flux before sending it to the paint shop.

Simple wood construction methods are outlined in building the express reefer model to O, OO and HO scale.



(Photo by R. D. Manners.)

MAKE AN EXPRESS REFRIGERATOR

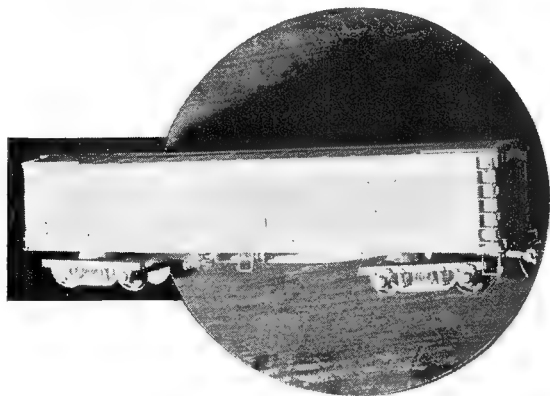
THE express refrigerator car is designed to carry oysters, produce, fish or other perishables requiring ice in transit. The car is equipped for passenger train service and the A. R. A. classifies it as "BP." It is usually placed at the head of long passenger trains and invariably at the rear of a short local train, ostensibly to allow the crew to shunt it on a siding without much ado.

Freight car construction is used in building the model and the proper materials and dimensions for building to O, OO and HO scales are given. Three-ply $\frac{1}{8}$ " veneer is used for the sides and

the scale followed. The HO sides should be cut to measure 31 x 175 mm., the OO gauge sides 36 x 200 mm., and the O gauge sides $2\frac{1}{4}$ " x $12\frac{1}{2}$ ". The plywood panel you buy should be at least $12\frac{1}{2}$ " wide for the O gauge version with the grain running the long way so that the scribing can be made with the grain of the wood. This is important for all gauges.

Cut the car ends as follows: for HO, 28 mm. wide; OO, 32 mm. wide, and O, $2\frac{1}{8}$ " wide. In each of the above cases one end of the piece is cut square and the other end is cut to the angle of the roof slope as shown in Fig. 4. On some house cars the sides extend down below the end, but in our case the parts are flush. In laying out the pitch of the roof on the O gauge car ends, make the ridge of the roof $\frac{1}{8}$ " higher than the eaves. For OO gauge this would be 2 mm., and for HO, $1\frac{3}{4}$ " mm. The floor should be $\frac{1}{4}$ " thick and it can be cut from 3-ply veneer or regular lumber. Cut the piece exactly the same width as the end pieces; the length of it is determined by subtracting the thickness of the two ends from the length of the car sides.

The parts are now ready for assembly. A choice can be made at this time in regard to the scribing of the car. This can be done now as shown in the upper photo on page 12, or it can be done after the sides, ends and floor are put together. The lower photo shows the first step in assembling the parts. Small bank pins should be procured for nailing the parts together to prevent the wood from splitting. The parts to be glued should be fitted before the glue is applied.



The completed car ready for extra hardware details.

ends and the floor should be made of $\frac{1}{4}$ " thick material for all sizes. The roof is made up of two pieces of $\frac{1}{2}$ " stock for the HO and OO models and $\frac{1}{8}$ " stock for the O gauge model. The roof walk, ice hatches and end platforms are also made of either $\frac{1}{2}$ " or $\frac{1}{8}$ " stock, depending upon



Left: Method used to scribe sides and ends of car. Notice that the square and the side are held firmly with one hand, leaving the other hand free to do the scribing. Below: Using small bank pins to fasten the car end to the floor. Clip off head of pin before "driving home."



Do not drive the pins in all of the way, but clip off the heads of the pins before the last blow is delivered. By doing this it is hard to recognize just where and if pins were used to fasten the parts together. After the ends are mounted flush with the floor, fasten the sides in place as shown on page 57. The sides lap over the ends and the floor as shown. Glue and pin them in place. Next, cut and fit a center partition as shown in the next photograph. The shape of this piece is exactly the same as the end piece except that $\frac{1}{4}$ " is allowed for the floor. Fasten this part in place.

Before the roof pieces are attached, the parts that have been assembled should be carefully sanded to iron out any differences in the outside surfaces of the sides, ends and floor. If the parts have been cut correctly these differences should be so slight as to make sanding hardly necessary. If the scribing has not been handled before it should be now. Rather than guess at the spacing of the scribe marks, it is well to lay them out with a ruler first and then do the scribing. There is a natural tendency to do the scribing correctly at first but due to the tediousness of the operation the spacings gradually widen out with no good effect. We write a letter in longhand much the same way. If the last line looked as good as the first one . . . well, you know what I mean.

The roof is made up of two pieces of clear white pine. Cut the pieces $\frac{1}{16}$ " x $\frac{1}{4}$ " x $12\frac{3}{8}$ " for the O gauge model. Use $\frac{1}{32}$ " stock for OO and HO. The pieces should measure 20 x 204 mm. for OO, and 18 x 177 mm. for HO. Make two of each. If you or your friends do not have a power circular saw, a local mill will cut these parts for you.

Glue and pin the roof pieces to the assembly as shown on page 57. After the glue has dried sand the roof, taking out any blemishes at this time because it will be next to impossible to do this after other details are added.

A glance at the top photo at the beginning of this chapter will show the rabbeting which is referred to as Fig. 2 in the drawing. This bit of modeling can be effected by tacking a guide strip to the side of the car as shown in the lower photograph on page 59 and then filing away the unwanted material. To get a clear, clean-cut rabbet, the sides can be cut with a razor blade

down to the center layer of the plywood, using the guide strip to good advantage in doing this.

The letterboard of this car is of cardboard and is cut to either $\frac{1}{4}$ ", 4 mm., or $3\frac{1}{2}$ " mm. wide, depending upon the scale. Fit this material on the ends of the car first, cutting it flush with the sides after cutting to a nice fit at the center. The card strips are then fastened to the sides of the car and are cut to overlap the end material. This gives a pleasing, professional appearance to the model. The cement used for fastening the various parts together can be purchased from any of the hobby stores that handle model airplane supplies.

For the roof details, refer to the page of drawings. Notice that a number of strips are fastened to the roof. These are also made of cardboard and should be cut $\frac{1}{8}$ " wide for O gauge and $\frac{1}{16}$ " wide for the other two gauges. Lay out the location of these 13 strips as shown in the drawing, which is scaled $\frac{1}{8}$ " to the foot. Coat one side of

the strips with cement and fasten them to the roof, trimming off the excess material after the glue has dried. Use a square to make positive that the strips are square across and parallel to each other.

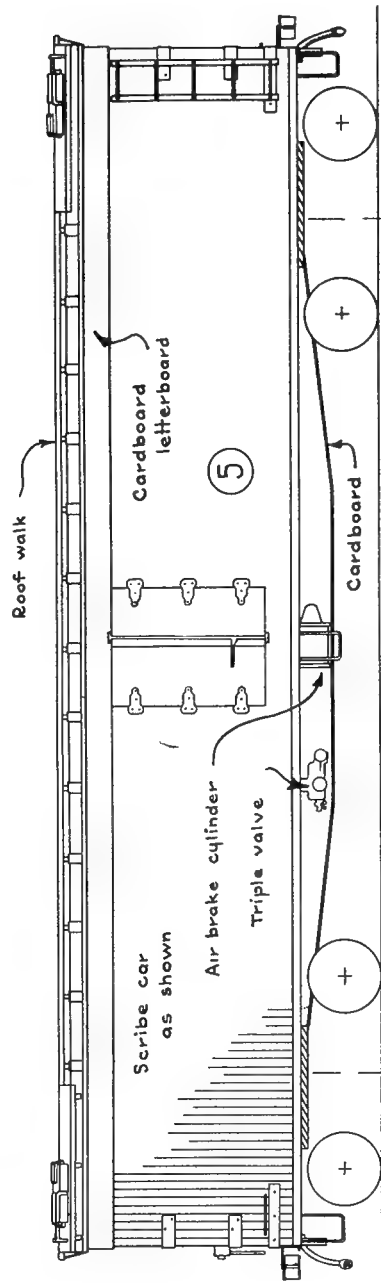
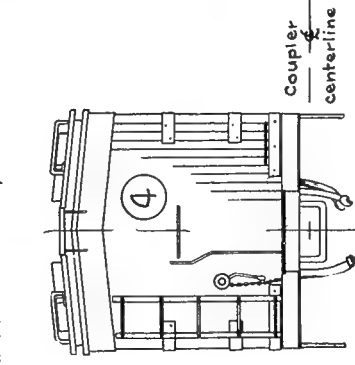
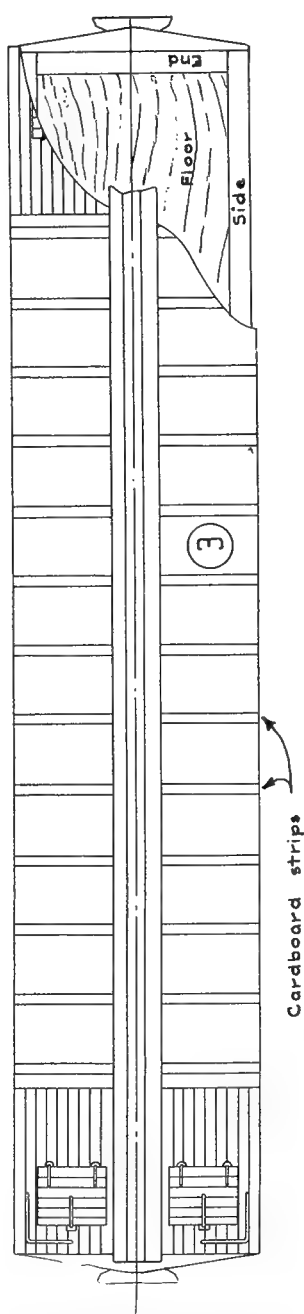
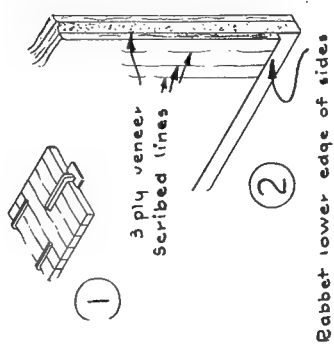
The roof walk and floor walks are cut the same thickness as the roof. For O gauge the walks should be $\frac{7}{16}$ " wide; OO, 7 mm. wide, and HO, 6 mm. wide. Scribe the walks lengthwise to represent the three planks seen on the prototype. The four end walk pieces are cut 1" wide and $1\frac{1}{16}$ " long for O gauge, 16 x 27 mm. for OO gauge, and 15 x 24 mm. for HO. The roof walk can be cemented and pinned directly to the roof strips, or, if your fancy dictates, small strips of wood can be glued to the roof strips to form supports for the roof walk, as shown in the drawing, Fig. 5. In either case, the end walks should be shimmed up with either cardboard or wood strips to obtain the effect shown in Fig. 4. These parts should be carefully sanded so that the sharp edges are not

rounded off. Four hatch covers are bought or made up as shown in Fig. 1 and placed in the positions shown in Fig. 3. If these are to be made up, use $\frac{1}{16}$ " thick material for O gauge and $\frac{1}{32}$ " thick material for OO and HO. Hatch covers vary some in size and the following dimensions will be acceptable: $\frac{5}{8}$ " x $\frac{3}{4}$ " for O gauge; 10 x 12 mm. for OO gauge, and 9 x 10½ mm. for HO. The hatch hard-

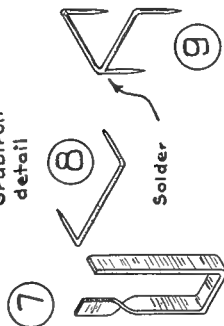


Above: Placing the side on the assembled ends and floor. Glue and pin the sides in place as shown. Right: One side of the roof being fastened to the side and ends of the car. The center partition is used as a roof brace.

Match detail



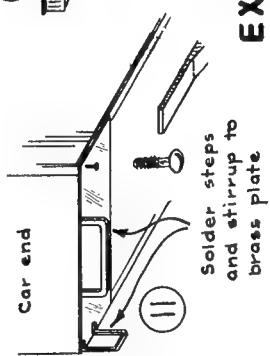
Grabiron detail



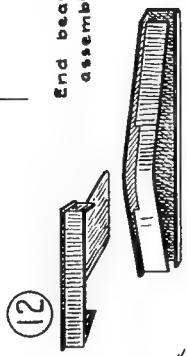
Brake reel



Car end



End beam assembly



13



GREAT NORTHERN
EXPRESS REFRIGERATOR
1/8" = 1' 0"

Frank Taylor

ware is made from small pieces of brass and cardboard.

For simplicity the I-beam shown attached to the bottom of the car in Fig. 5 can be made from a square piece of pine measuring $\frac{3}{8}$ " x 8" for O gauge and 5 mm. square by 128 mm. for OO gauge, and this length is varied to 110 mm. for the HO version. Notice that this piece does not include the cross hatched section shown directly above the truck center line. The reason for this

with a pair of four-wheel passenger trucks. For O gauge a pair of Commonwealth outside equalized passenger trucks should be specified. To date these are not available in the other two gauges and for that reason use the kind that are available. The difference between the two is hardly discernible unless you happen to know what to look for, and the average person doesn't recognize the difference.

Before attaching the ladders to the body, cut



Left: Car body assembled with letterboard and roof details added. Method of fastening end beam shown. Lower photo: Rabbit being filed to shape with file guide in place.

is that the truck bolsters vary in height from the top of the bolster to the top of the rail, depending upon who manufactures them, and for this reason some variation in the thickness of the underframe at this point will need to be made in order to raise the car the proper distance above the rails. This is important in that you might find it impossible to locate the couplers correctly if the above procedure is not followed; and what good is the car if you cannot couple it up with the rest of the train? Plane a bevel toward each end of the underframe piece and then glue and pin it in place as shown in Fig. 5. A strip of cardboard can be cut slightly wider than the piece and glued to it to form an I-beam effect.

The ladders, along with an air brake cylinder and triple valves, can be purchased from any of the various manufacturers very reasonably, and for this reason methods of making these parts will not be discussed. It goes without saying that a pair of couplers should also be purchased along



several strips of cardboard and from them form the corner plates as shown in Fig. 5. Three of them are fastened to each corner, the low one being twice as long as the other two. Compute the measurements from the drawing. Next, fasten the ladders, using the holes provided in the O gauge parts; for HO or OO either bend over the ends and force them in place or drive in nails and solder the ladders to these nails.

The stirrup steps can be made two ways, as shown in Figs. 6 and 7. Six of these will be necessary for the car. If steps as in Fig. 7 are used, these can be attached to the car by drilling two holes in each step and fastening them with bank pins. In this case do not clip off the head of the pin. The steps as shown in Fig. 6 are fastened to the car by soldering them to a plate made of thin brass stock. This plate can be cut from $\frac{1}{2}$ " to 1" wide and the other dimensions should equal the width of the car. It is nailed in place and only serves as a convenience in soldering the steps, hoses, and coupler stirrups in place. A plate can also be provided at the center of the car so as to allow the steps to be soldered in the position shown, or as an alternative, a simple U is formed from wire with the ends sharpened (in effect, a staple with square corners) and then forced into the side of the car. The coupler stirrup is made from $\frac{1}{32}$ " square brass stock and serves as a support for the swinging end of the coupler shank. The coupler is fastened in place by using a wood or machine screw through a hole in the coupler shank at the far end to allow maximum swing of the coupler head. This swing is necessary because the passenger cars to which this piece of equipment is attached require more coupler swing than a freight car.

As previously mentioned, this car is designed for use in passenger train service and therefore must be equipped with the passenger type of air brake cylinder, triple valve and double air hose, along with the steam connection pipes. These are shown in Fig. 4. A blob of solder can be filed to form the connection at the bottom of the hose, which, incidentally, is bent from an appropriate piece of brass wire.

Quite a bit of detail can be added in making the end beam assembly as shown in Figs. 12 and 13. A good effect can also be obtained by handling these parts in a simple way. The assembly shown in Fig. 13 is fastened to the end of the car, being soldered to the bottom plate for permanency. It is bent up from brass stock about .012" thick and formed to the shape shown in Figs. 3, 4, and 5. The buffer part of the assembly shown in Fig. 12 is bent up from a single piece of the same material and can be soldered solidly to the end beam, or a way of springing it can be worked out if you deem this action necessary. There is no point in making it so if your other passenger cars are equipped with dummy buffers. If it is to be made workable, a piece of phosphor bronze strip can be bent to obtain the springing quality. The positions of the triple valve and air brake cylinder reservoir are shown in Fig. 5, and these can be either pinned or cemented in place.

The brake wheel and brake handle assembly as shown in Fig. 10 are simple turnings, the handle being fashioned from a piece of $\frac{1}{16}$ " or $\frac{1}{32}$ " square brass stock for the various gauges. Drill a hole in the end and force the brake wheel in place. A small chain can be stretched between it and the end beams for effect. The air line shown in Fig. 4 is a piece of round brass wire, and a valve can be attached to the top of it by forming a blob of solder to the wire at this point.

The grab irons are bent from brass wire as shown in Figs. 8 and 9 and are forced into the car body and roof in the positions shown in the drawing.

The door hardware can be painted on, or pieces of cardboard can be cut to the shapes shown and cemented in place. The door handles and rods can be made from square brass stock and filed to shape. Hinges are available for the O gauge model and transfers for a number of different roads are also offered by manufacturers for the various gauges. Paint the car to suit your fancy, or, if the prototype is followed, Pullman green should be used for car and trucks.

As a last operation, fasten the trucks to the body and the car is ready to roll.



MODEL GRADE CROSSING

Modeling of Concrete Road, Gates, Watchman's Shanty to "Big 3" Scales.

GRADE crossings create a necessary hazard on all railroads except model pikes. Nevertheless the working gates and the realistic atmosphere created make the crossing project worthy of consideration. The materials necessary are easy to obtain and the plans are drawn up in full size in the three popular gauges.

It will be well to construct the crossing on a separate piece of baseboard for the sake of convenience, and make provision for the baseboard panel in your layout so that it can be installed after completion.

The two tracks are laid first as shown in the plan. These are spaced on 15 ft. centers. Lay out the angle of the road at the crossing in the form of a center line. From this line lay out the boundary lines of the curbing and the sidewalks. The roadway is leveled up across the tracks by using planks. A single strip of wood can be fitted between the rails and scribed to simulate the planking. The thickness of this piece should be equal to the space between the top of the ties and the top of the rail. Be sure to leave clearance for the flanges of the wheels. A section of wood

can be fitted between the two tracks and two lines scribed on each side of this insert to carry out the planking idea. Refer to the drawing.

This particular grade crossing is in a valley and the road dips down toward the track from each direction. A piece of plywood can be used in building up the roadway, shims being placed under the plywood to form the grade. The sidewalks are made in the same way. Notice that the grade of the sidewalk near the watchman's shanty is steeper than the road, thus causing a curbing to be formed near the shanty.

Stain the wood sections that represent the planking; black paint can also be used if it is wiped off with a rag immediately after it is applied. The planking, incidentally, is usually about 6" wide and from 8 to 12 ft. long. In scribing the wood to represent planking these measurements can be reduced to the appropriate scale. Mix up a batch of plaster of paris and quickly apply it to the surfaces representing the street and sidewalks. This material can be smoothed out with a kite stick. You will find that considerable modeling can be effected before the plaster of paris

sets. The curbing and the crown of the road should be incorporated before the job is dry.

The sidewalk and curbing lines should be scribed in the plaster just after it hardens.

The warning sign, "Look Out for the Cars," is made up of brass stock. The sign proper (X) is fashioned out of .013" brass flat stock. Refer to the drawings for full size templates for the different scales. This X is then soldered to the mast, which is a piece of brass representing a pole 6" in diameter. This would be about $\frac{1}{16}$ " in diameter for HO and OO gauge, and $\frac{1}{8}$ " in diameter for O gauge. Drill a hole in a flat piece of brass stock large enough so that the mast of the warning sign can be slipped through it and then cut the stock to an appropriate square shape. This will represent the base of the mast. Actually the sign stands about 13 ft. above the sidewalk, so solder the base to the mast at a point to represent this height.

There are several telegraph poles to be set. The most realistic poles can be procured by looking through the woods. Twigs of appropriate size can be picked out and the outer bark peeled off. The poles used in the setting are about 40 ft. in height and about 12" in diameter. After peeling off the bark, the wood can be treated with paint or stain to give a weatherbeaten appearance. Drill holes in the baseboard for a snug fit and push the poles in place.

A good material to use in the construction of the shanty is balsa wood. It can be cut easily with a razor blade and by using model airplane cement a strong structure will result. Use $\frac{1}{32}$ " thick material for all of the gauges. Use the full size template in laying out the sides and the ends of the shanty, and also the fuel box. When these are assembled glue the cardboard strips that represent the trim on the shanty before putting on the roof. Cut the roof pieces from $\frac{1}{16}$ " thick balsa wood. The overhang of the roof is about 9" on the end and the sides. Scale this down for your model. Glue pieces of celluloid to the inside of the shanty to represent the windows. White paint can be used to divide the openings that represent the six lights of glass. Glue a piece of balsa to the inside of the door opening and scribe it longitudinally to represent 6" wide boards. The photos show the method of supporting the rain trough, which, incidentally, is a solid piece of square wood stock. The chimney is a short section of round iron or brass stock fitted into a hole in the roof. If a lathe is available you can turn this piece down and make provision for the cap, which can be seen at the top of the stack.

Scribe the roof and the sides of the building, also the fuel box, and then paint both the inside

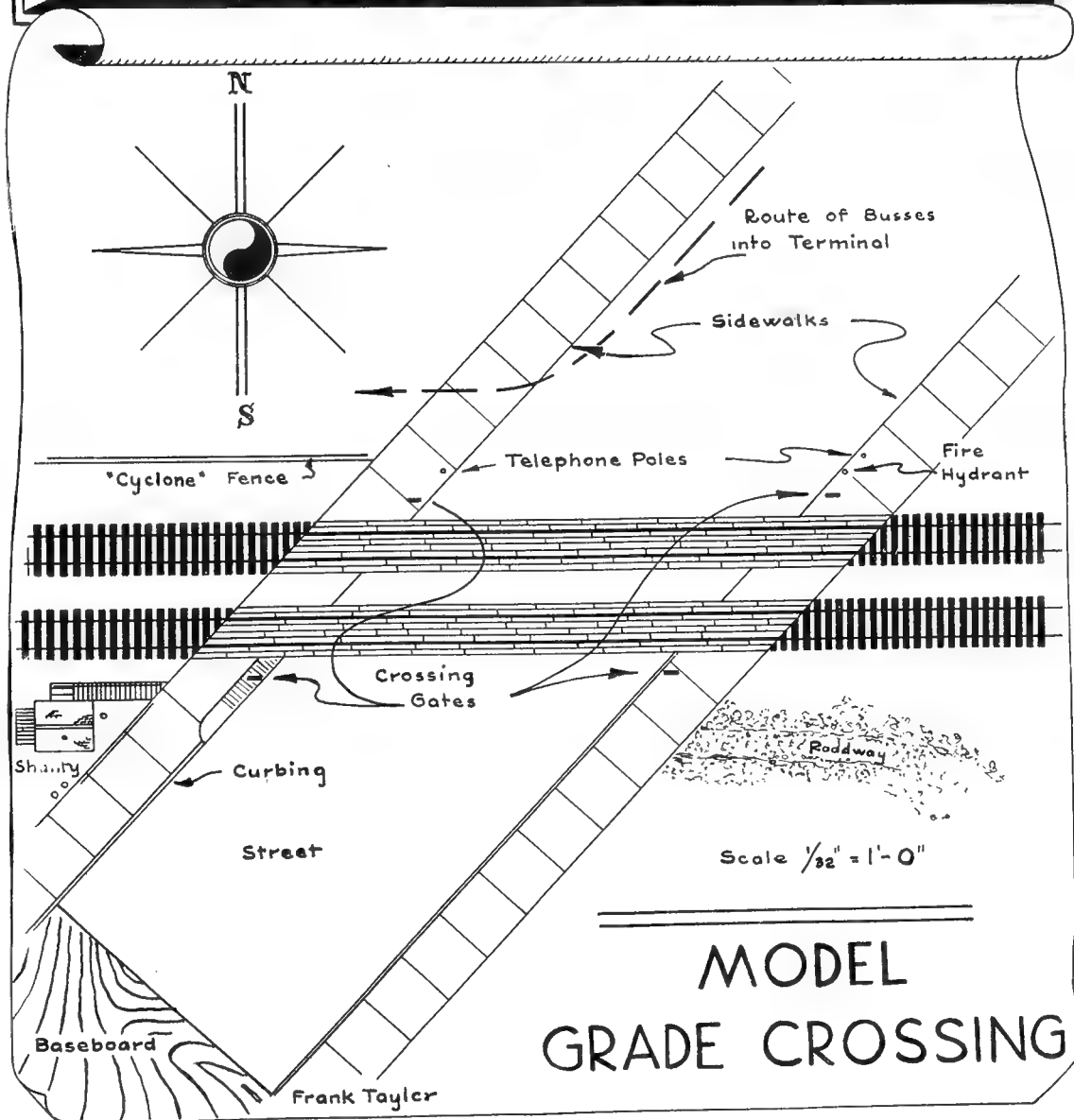
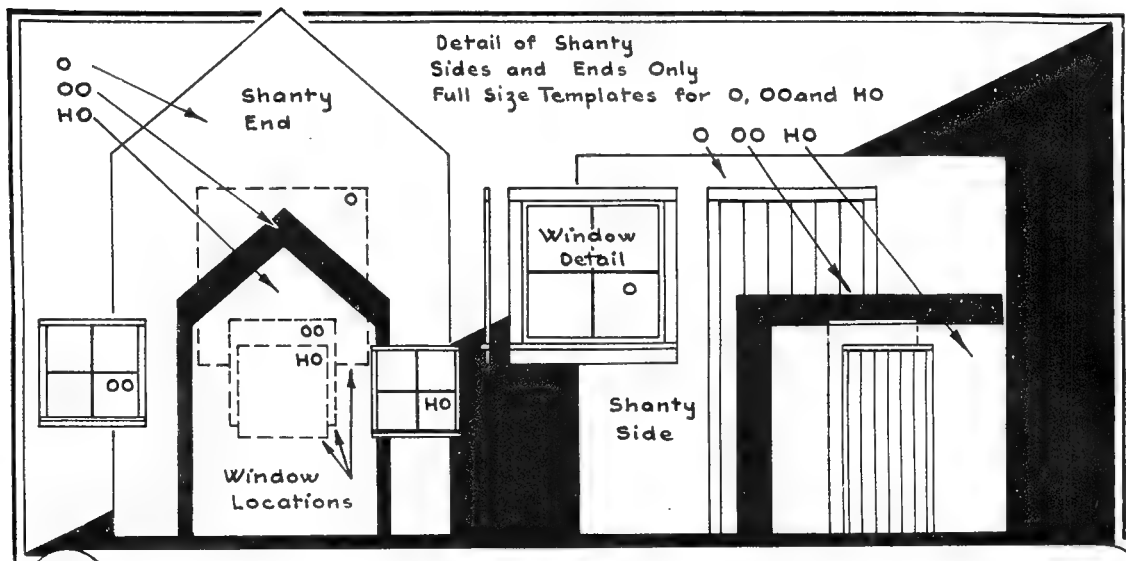


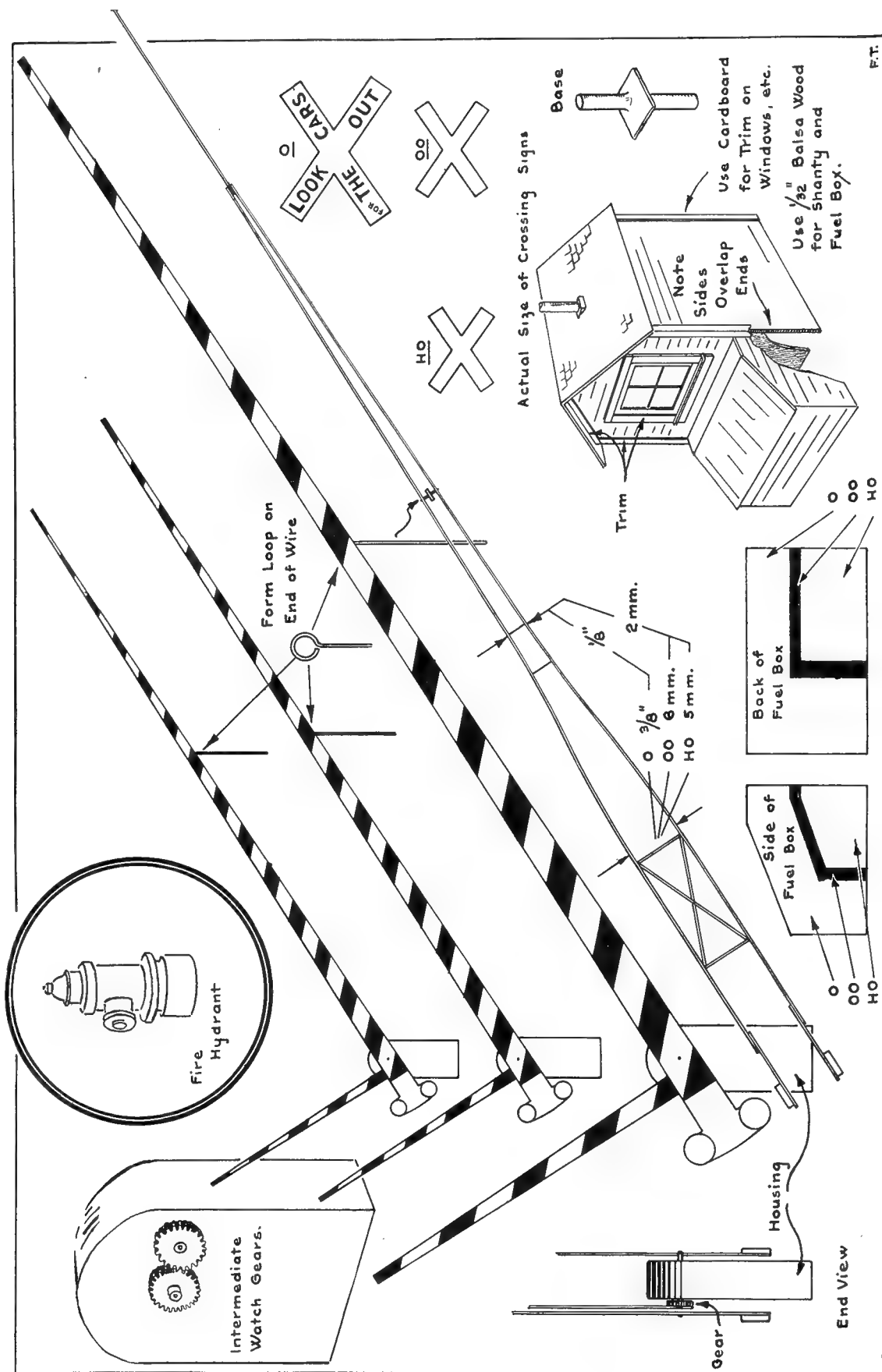
The prototype: Harwood Avenue and Milwaukee Road tracks, Wauwatosa, Wis.

and the outside of the building. The prototype is rather weatherbeaten, the sides and the ends being a drab gray and the trim, fuel box, and the roof a slight off-color red that looks something like a dirty box car. The chimney is painted black. The watchman's sidewalk, running parallel to the tracks, can be scribed from one piece of wood, or can be made up of separate planks. If the walk is made of one piece and properly discolored it will look very realistic.

The railings to protect the watchman and the pedestrians on the sidewalk help to give the model a finished look. It is said that a long time ago a watchman on duty during the early hours of the morning was awakened out of his drowsiness by the persistent ringing of the bells in the shanty, warning him of an approaching train. While in this half awake condition he inadvertently walked directly out of the shanty door and into the drive wheels of the approaching train. After that accident the railroad installed the railings.

Loose ballast can be used on the right of way or a permanent installation can be made by painting the section with a heavy grade of paint.





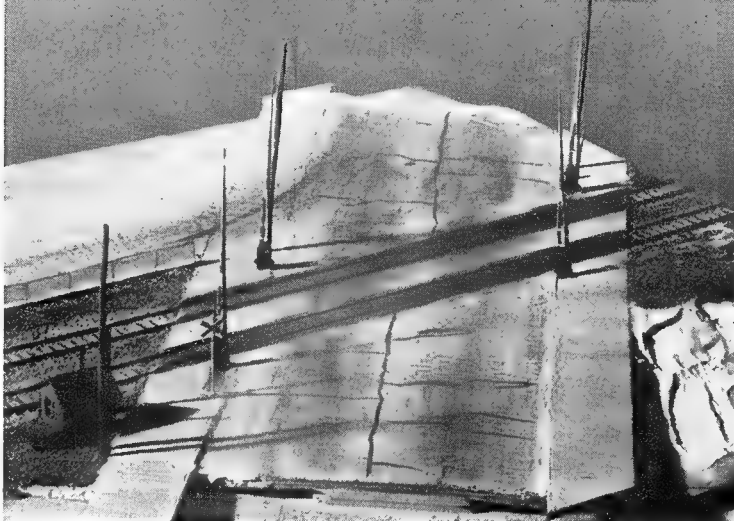
Sprinkling the ballast on this wet paint will hold the ballast in place after it dries.

The fence on the right of way border, just opposite the watchman's shanty, is made up by forcing up-right pieces of

wire into the baseboard, and then soldering the horizontal piece of wire which forms the top of the fence. A piece of material called voile can be purchased from your local dry goods store, and should be cut on a bias so that the effect is the same as the original woven wire fencing. The strip is stiffened by giving it a coat of thinned out varnish, and then glued in place.

Paint the roadway and the sidewalks to represent concrete by adding some black to the white paint used. A dirty gray is very desirable and this should be streaked with black to represent the oil and tire marks that usually discolor a street. Lines can be painted on the road to represent the cracks in the concrete that have been filled in with tar. As these cracks follow no definite pattern, you will have to use your own judgment as to just where to paint them.

The crossing gates are built up of flat brass stock about .012" to .014". Use the full size template in laying these out. Notice that eight pieces are necessary to make the four gates and four shorter ones are also needed to protect the pedestrians. The eight long ones are spaced as shown in the drawings with appropriate pieces of brass cut the same width as the gates at these points. The assembly can well be handled by building a jig or a form over which the various parts can be assembled and soldered together.



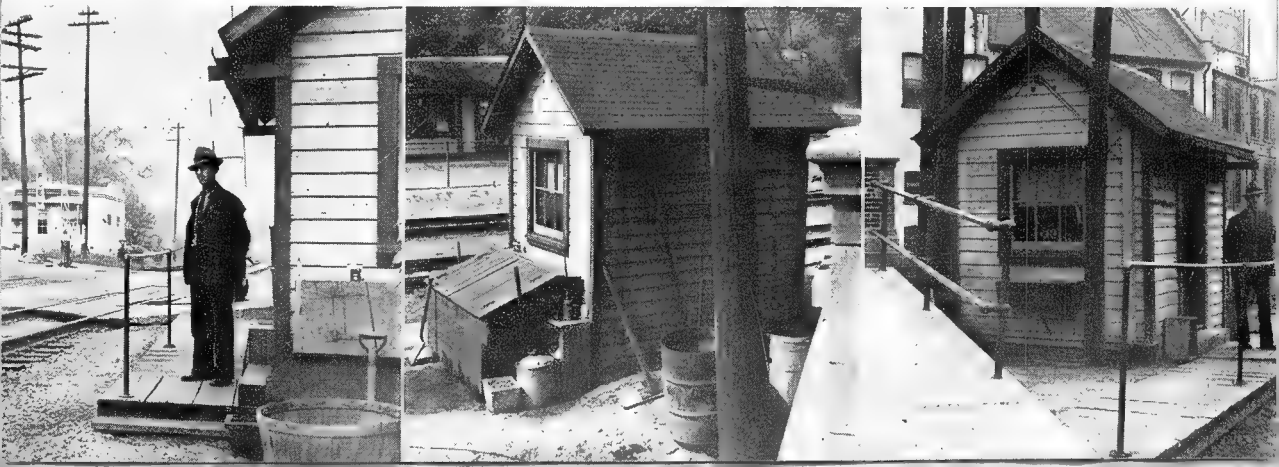
It was found that the use of intermediate gears from watches offered the best means of synchronizing the movements of the long and short gates. The assembly of these gears is shown in the drawing.

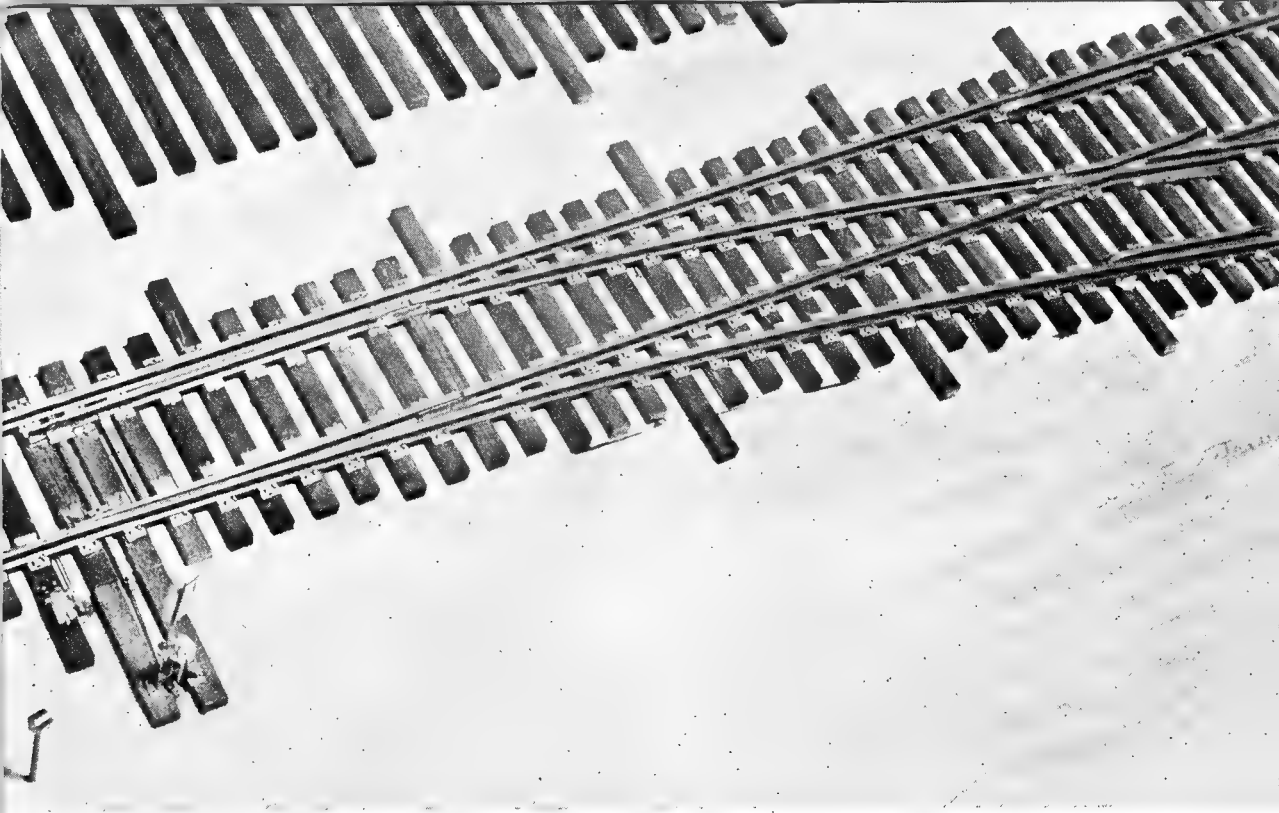
Any local jeweler can supply you with appropriate gears out of his collection of scrap watch parts. These gears are placed as shown in the drawing.

The means of working the gates from below the table will vary depending upon their size. The HO and OO versions will have to be operated by attaching a lever to the counterweights and then attaching a cord to the lower end of this. The O gauge model can be made by enclosing the mechanism in the housing, which can be made in the form of a hollow shell, out of flat brass stock. The shaft on which the main gate pivots can be formed to the shape of a crank inside the housing. A lever can be attached to this and brought down through the baseboard. The HO or OO gate can be fastened in place by drilling and tapping a hole in the bottom of the solid housing, and then running a machine screw up through the foundation and sidewalk.

Paint the housing black and give the gates a coat of white. After this is dry the black stripes can be put on with a brush. An ordinary pen and india ink will also do the trick.

The gates can be operated manually by connecting a control rod to the link projecting down through the base, or a solenoid can be used connected to a track circuit just as a semaphore signal would be.





DETAILED TRACK SWITCH

Locomotives and Cars Aren't Only Items Deserving Fine Workmanship.

ALMOST everything used in connection with a model railroad is modeled more or less to scale. The rolling stock seems to command the most attention and for this reason it is built more exactly to scale than the trackwork and scenery. Trackwork is second in importance from the attention drawing angle and consequently suffers from the want of detail. Scenery, contributing nothing to the actual running of the railroad, is looked upon as a time consuming necessary evil by some and is not even considered by others.

To show the possibilities in modeling trackwork an O gauge right hand turnout and the switch stand, switch indicator and switch box usually used with it was built in the experimental department of *THE MODEL RAILROADER*, bringing out the fine detail to the same extent as in model locomotive work. The same methods can be used, with less detail, for OO or HO.

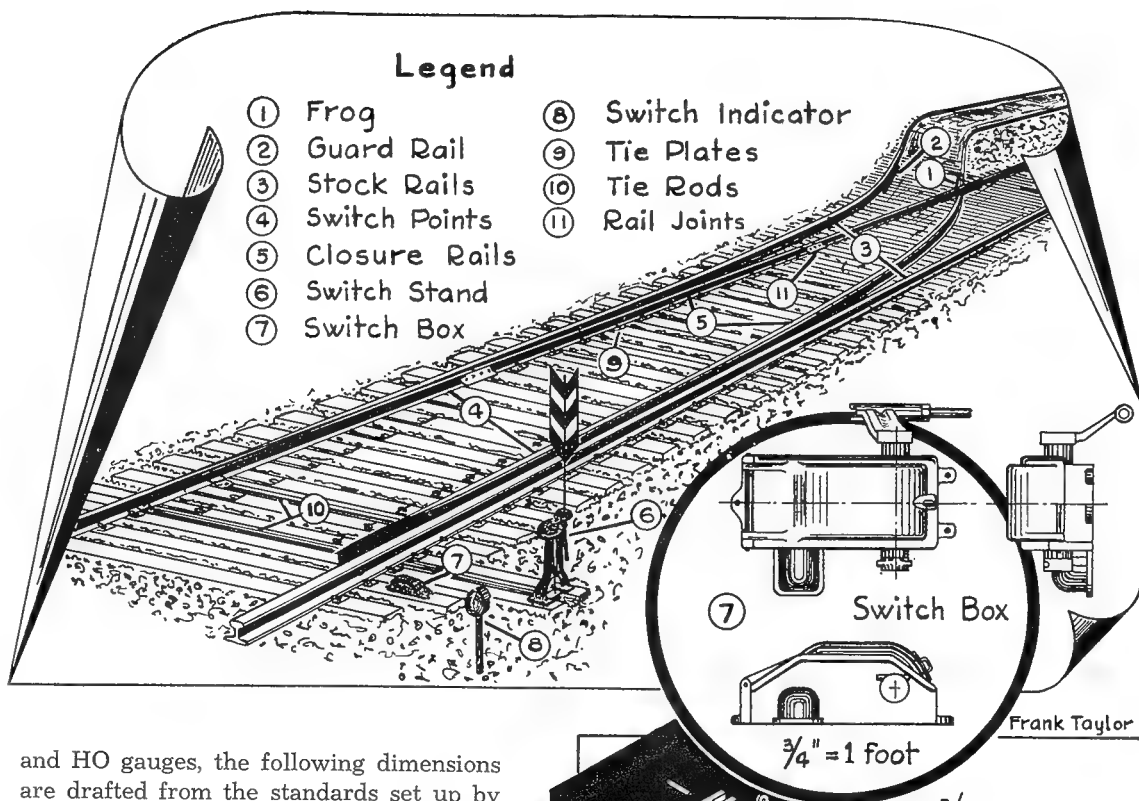
There are a number of materials and methods used in laying trackwork. Three-ply veneer is used for the base, and wood ties, steel rail and spikes are some of the other materials utilized although composition board, felt, composition ties, brass rail and a host of other substitutes can be used with confidence.

A layout should receive a good deal of paper consideration before the first board is cut. This will allow you to cut the plywood to the correct width, allowing for stations, signal bridges and other structures that can rest on the baseboard. As a rule, the plywood baseboard is cut as narrow as is possible so that the ballasting, drainage problems, etc., can be modeled without interference.

The No. 6 turnout was laid out by pasting a paper template to the baseboard. These templates are time savers and are low in cost (obtainable from Kalmbach Publishing Co., Milwaukee, 4 for 25 cents). The ties are glued directly to the template, which is eventually covered over with ballast. Notice that the length of the ties is increased in 6" steps. Ties on the parent track are 9 ft. long and these are increased to 9'-6" after the ties for the switch stand are laid. Five 9'-6" ties are followed by four 10 footers and so on. The longest ties used on this switch are 17 ft. long. If outside third rail is to be installed, a longer tie should be laid after every fifth regular tie. The supports for the third rail are fastened to these ties in due order. To determine the length of the third rail ties for O, OO

Legend

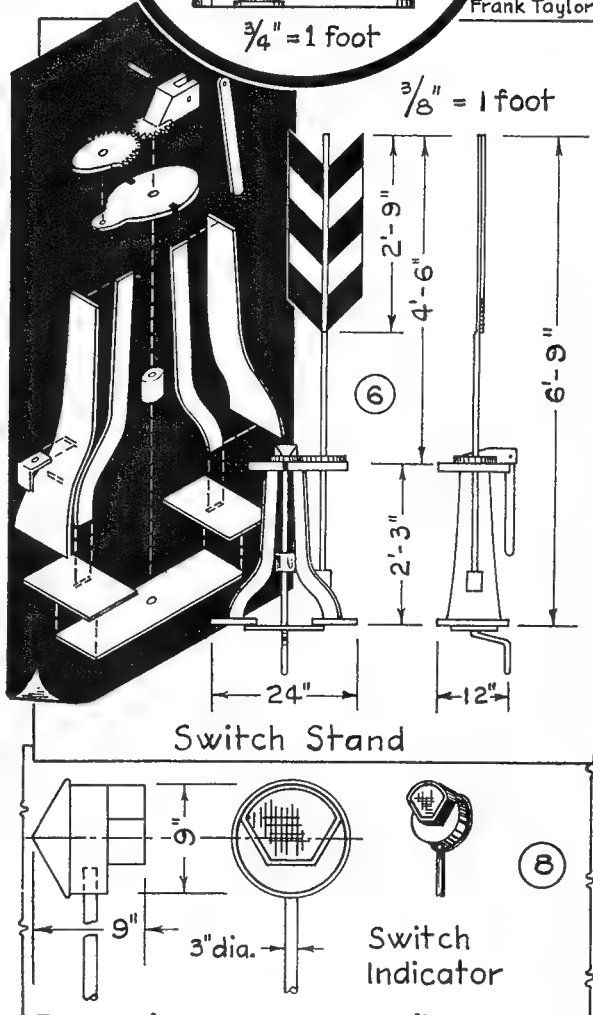
- | | |
|-----------------|--------------------|
| ① Frog | ⑧ Switch Indicator |
| ② Guard Rail | ⑨ Tie Plates |
| ③ Stock Rails | ⑩ Tie Rods |
| ④ Switch Points | ⑪ Rail Joints |
| ⑤ Closure Rails | |
| ⑥ Switch Stand | |
| ⑦ Switch Box | |



and HO gauges, the following dimensions are drafted from the standards set up by the N. M. R. A.: Third rail center out from gauge: O, $1\frac{1}{16}$ "; OO, 10 mm., and HO, 8 mm.

After the glue holding the ties to the template has dried, the straight stock rail is laid in position. This rail really is the nucleus of the whole switch and great care must be taken to lay it straight. Tie plates are placed under the rail at each tie. Although four holes are provided in the tie plate for spiking, only two of these, diagonally opposite, are used. One spike on each side of the rail at each tie is plenty. Next, lay the other stock rail down; line it up with the template as the spiking progresses. The curved stock rail is usually bent slightly at the contact point of the switch rail.

Stock rails on model railroads are usually notched to take the switch points, and while this works O.K. mechanically it is not true modeling. The stock rails are not notched for a full size switch and it is not necessary to do so in the model. So much for that. The next step or operation will be to fabricate a switch frog. A switch frog, incidentally, is a device or part used to enable the wheels running on one rail to cross a diverging rail. Standard rail is used. File an angle, comparable to that shown on the template, on the opposite



sides of two rails. When placed in position to form the point of the frog one rail point should overlap the other. Lay the parts directly on the template and solder together. Bend two rails to form the wing rails. These are placed one on each side of the point and all of the parts soldered to a thin plate as shown in the photo. The opposite ends of the rails we just bent are called closure rails. These can extend to where the switch points are located. After cutting these ends to length and filing off the burs, the wing rails are filed at an angle to allow the wheels to track properly.

The finished frog is moved up to a point where both of the rails which form the point are in gauge with the stock rails. A few spikes can be driven "home" temporarily to hold the frog in place while the tie plates are slipped under the rails. Two guard rails are then cut to length and filed to match the wing rails. These are spiked in the positions shown and soldered for additional security. The clearances between the guard rail and the stock rail and also the wing rail and the point should be given special attention. If too narrow, the wheels will mount over the obstruction and derail. Too much space between the parts defeats the purpose of their existence. The wheels will be likely to split the point and hit the ground.

To complete the switch a pair of switch rails are made, called right or left hand switch points according to position on the right or left hand side of the turnout. These switch rails are made of the same rail used for other trackwork. The fixed end of the switch rail is called the heel of the switch and is connected to the closure rails by a rail joint. For modeling purposes the rail joints are made a loose fit to allow the switch rails to pivot. The popular belief that a straight edge or ruler placed across the heads of the stock and the switch rails should touch all of them is incorrect. The switch rails actually are higher than the stock rails. The riser plates used under the switch and stock rails are long enough to provide bearing surface for the movable switch rail and the plate is thicker through this section than when it is under the stock rail. The reason for raising the switch rail is to make it easier to machine the points for a good contact with the parent rail without removing too much stock and causing structural failure. Besides filing the stock rail side of the switch rails, the bottom edges are filed on a bevel to allow for a good fit at the base of the rail. This is what the railroads do instead of notching the stock rail. The tops of the switch rails are then chamfered at the point or head end to effect a drop slightly below the tops of the stock rails, a final touch made with a file to

sharpen the edge of the point. The heel of the switch rail marks the point where the rails begin to level off. This gradual lowering is done with the closure rails. Graduated risers are employed for support. For model work, the commercial tie plates can be bent to take care of this variation.

The correct relative position of the switch rails in relation to each other is important and this is controlled by the use of switch or tie rods. The rod nearest to the point of the switch is called the head or No. 1 rod. This rod is long enough to go beneath the stock rails, thus acting as a hold-down for the switch points as well as the means for throwing the switch, one end being left long enough to connect with the switchstand rod or other device. The other rods are numbered 2, 3, 4 and 5, if there are that many on the switch being modeled. Clips are used as a means of securing or connecting the rods to the switch points. These can be made from thin metal and soldered in place. Holes drilled through these parts and the tie rods will provide a means of using bank pins for fastening. The connections should be free moving so that the points will not bind in any position.

There are several things that are worthy of special note concerning switch construction, principles and common errors that you should be aware of. In a nutshell they are: (a) the point rails should have no curve in them; (b) the track running parallel and adjacent to the guard rails should be straight; (c) all rail curvature between the frog and the points is made in the closure rails only; (d) the tracks through the frog should line up perfectly just as though the frog wasn't there; (e) the track should be in gauge with the points thrown in either direction.

Construction of Switch Stand and Other Switch Accessories.

To add further realism to the completed turnout, a switch box, switch stand and switch indicator can be installed. The switch box is a rather diminutive bit of model work but the small things count up more than the size would indicate. A switch box, you would know, is a container for the electrical contacts used to control the signal circuits. All switches in block signaled or interlocked territory are equipped with these boxes.

The box is filed to shape on the end of a piece of square brass rod and is cut off as a last operation. The shape of the cover and the other details such as the lid contour, hinges, etc., are filed in the brass piece before the execution takes place. A hole for the shaft is drilled through the box. If the hole is drilled slightly smaller than

the shaft it will not be necessary to solder the parts together. The arm on the end of the shaft is bent as shown and soldered in place. A dummy shaft is soldered to the lower end of the arm and cut off beneath the rail nearest to the box. Notice that the switch box is mounted on a tie slightly longer than the average. Spikes are used to fasten the apparatus to the tie. Solder lightly.

The switch stand is of a design popularly used and is simpler to model than one would suppose. The best material to use is sheet brass about .012" thick. Lay out the legs (3) and file away the shaded section (1), Fig. 1. Next, file out the plate that supports the gears and solder it to the top of the legs. This plate will hold the top of the legs in position while the shaded portion (2) is filed away. The lower half of the legs is then held together by soldering the bearing, shown dotted in 2, in place. The procedure just outlined can be used to good advantage in other model work by applying the principles to suit the problem. For example: The two feet on the bottom of the legs can be laid out as one piece to include the space between the legs. After it is soldered to the legs the section between the feet can be removed. To facilitate the removal of the piece, a three-cornered file is used to make the two cuts through the thin material. The beauty of this method is that the legs, in one case, and the feet, in the other, were soldered in exactly the right place, using the least number of parts.

To swing the step by step arrangement of the construction back in proper sequence, solder the flanges to the outside edges of the legs. Notice that the material tapers toward the top. The feet, previously mentioned, are then soldered in place. A plate is soldered to the bottom of the feet and serves as a bearing for the lower end of the center shaft. The same thickness material can be used for all of these parts except the top plate, which should be somewhat thicker. Bend a small bracket and solder it, as shown, to the leg. A hole, to line up with the one in the top plate, is drilled in the bracket for the off-center shaft.

The gears used on the shafts can be obtained from a local jeweler. Ask for a Cannon Pinion and an Intermediate Setting Wheel. The ratio is 2:1—perfect for our use, as the throwing of the lever through 180° effects the rotation of the target spindle 90°. The gears will need to be bushed for a snug fit on the shafts or spindles. The best way, of course, is to chuck a piece of round brass stock in the lathe and bore a suitable hole through it before turning the outside diameter down to fit the hole in the gear. The lack of a

lathe should prove no obstacle because a piece of flat brass stock can be drilled, soldered to a shaft and then filed to fit the hole in the gear. The bushing can be soldered to the gear if too loose a fit is obtained.

File a target to the shape shown and solder it to the shaft. Slip the shaft in place and solder a retaining ring to it. This ring can be a small piece of wire wrapped once around the shaft and soldered in place directly under the top plate. The gear on this shaft is soldered in place. Put a shim of paper between the gear and the plate before soldering them. The removal of the paper will then provide the clearance necessary for free turning. A crank is bent on one end of the other shaft before it is installed. Feed the straight end through the hole in the lower plate, the middle bearing, the top plate and finally the gear. Draw the shaft up so that the crank rests against the lower plate before soldering the gear to the shaft. Don't forget to insert the paper shim before soldering.

The handle is the only remaining part to be made. This is fashioned from 1/32" thick brass with a hole drilled at one end for the pin. The block or hinge jaw that the handle is fastened to is filed to the shape shown and soldered to the gear mounted on the crank shaft. A paper shim is necessary to prevent the solder from doing too good a job. Line the target up parallel to the track and have the handle and lower crank in correct position before soldering the block to the gear. Cut a notch in the top plate for the handle to fit into when in this position and another to lock the handle through 180°. When the handle is dropped in either of the slots the crank should lock the switch points in either position.

Spike the switch stand to the two long ties provided and measure the space between the hole in the No. 1 switch rod and the crank on the switch stand and make a connecting rod with holes spaced a similar distance apart. After installing the rod some difficulty might be experienced in balancing the throw of the crank with that of the switch points. Find the differential in the throw and elongate the hole on one end of the rod to compensate.

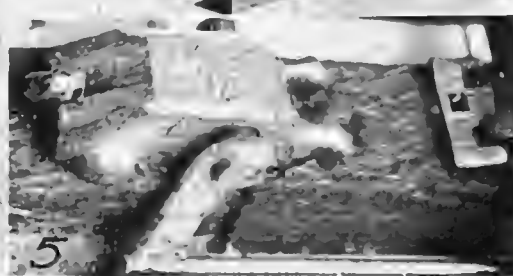
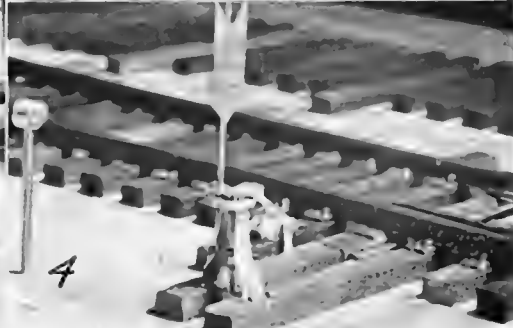
Switch indicators are frequently installed in block signaled territory and give visual or audible indication or both of an approaching train. The indicators are placed near the switch and are controlled by circuits to give warnings of a train's approach and when such indication is made the switch must not be tampered with until the train has passed through it.

The type of indicator shown is turned from round brass rod. One end is cone shaped and the



Fig. 1.

Detail photos of completed O gauge switch: (1) Switch point and clips for switch rod; (2) Frog and guard rails; (3) General layout showing points, switchstand, switch box, and indicator; (4) Another general view; (5) Closeup of switch box.



other end is filed to the shape shown. A hole, to take the mast, is drilled in the bottom side of the head. If the hole is drilled a bit too large, a tight fit can be made by burring up the end of the mast or the mast can be tinned with solder.

The completed switch should be ballasted with loose scale ballast. To secure it in place, model airplane cement thinned with amyl acetate or acetone is dropped between the ties with a medicine dropper.

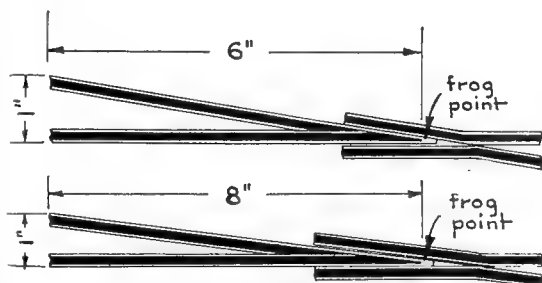
MAKING A DOUBLE CROSSOVER

Four Turnouts and Diamond Crossing Permit Free Movements in Crowded Space.

A DOUBLE crossover is of particular use to the model railroader due to lack of space on his pike, especially around the throat leading into the yard or station. In order to make the necessary switching moves at these points it is necessary to be able to cross from one track to another in either direction. A single crossover in one direction followed by another single crossover in the opposite direction would allow this to be done, but the space that these two crossovers would take up might not be available, so the next best thing is to install the double crossover.

Briefly, a double crossover is made up of four turnouts (erroneously called switches) and a diamond crossing. Two left hand and two right hand turnouts are used. Bear in mind that a No. 6 frog or larger is the best to use.

There is a definite relationship between the number or angle of the frog and the total length of the turnout. See sketches on this page. For example, a No. 6 frog is greater than a No. 8, the angle being 1 in 6, compared to 1 in 8; hence the No. 6 turnout is shorter. If you wish to determine the frog number of a given frog, lay a piece of paper over the rails and rub a pencil on the top side so that you get an accurate tracing of the rails. Extend two lines on this paper along the running side of each rail from the frog point a couple of inches or so. Find a place where these last-drawn lines are, say, $\frac{1}{4}$ " apart (one unit); draw another line across the two rails here. Now if the distance from the center of this last-drawn line to the point of the frog (where the rail lines cross) is $1\frac{3}{4}$ " (seven units), the frog is a No. 7.



Comparison of frog angles.

Once the frog number is decided upon, the other factors that enter into laying out the turnout can be taken directly from tables prepared by the railroads. A separate table has been prepared for each size of frog so that the turnouts for each number will be standard in size.

A No. 6 turnout is generally used by the model railroader and full size templates are available, making reference to railroad switch tables unnecessary. These templates are printed on both sides of a tough grade of paper and are to be cemented to the baseboard. The turnout is then built directly on the template.

The angle of a No. 4 turnout would be so great that many locomotives would not be able to negotiate it without jumping the track. Using a frog this small would tend to condense the crossing at the intersection too, and this would cause complications in more ways than one.

There are a number of ways of constructing a double crossover depending upon the material used. A quick easy way of making this trackwork would be to use a cast frog for the turnout and another casting for the crossing. This last-named casting is available in a number of different degrees of crossing. Some objection might arise in that the castings are available only in brass and this would not look well if used in connection with steel rail. Many fellows shy away from using regular rail to form frogs and switch points but perhaps this is because they are afraid of the job. Actually brass and even steel rail files rather easily, and the fellow who does not build up his own point work is missing out on a nice phase of the hobby.

Railroads use both the cast frog and the type built up from running rail. So you will be using the right procedure and materials in whichever way appeals to you. This outline is given merely to acquaint you with the facts and the preferences of the average model railroader.

To start on the actual construction it is well to decide on the spacing between track centers. If your trackwork is not already installed it is strongly suggested that you space the tracks 16 ft. apart, which is roughly 4" in O gauge, 64 mm.

in OO gauge, and 56 mm. in HO. These spacings should be adhered to in the yards, the throat and the sidings, to allow for the overhang of the cars. Even on the main line, where the track spacings are sometimes kept to scale (13 ft. minimum), it is a good idea to change to a wider spacing for better operation. It is common practice to widen out the tracks on curves on the main line to allow for car overhang, so it can readily be seen that this should be considered when laying out the yard, due to the smaller radius curves that are usually incorporated at this point.

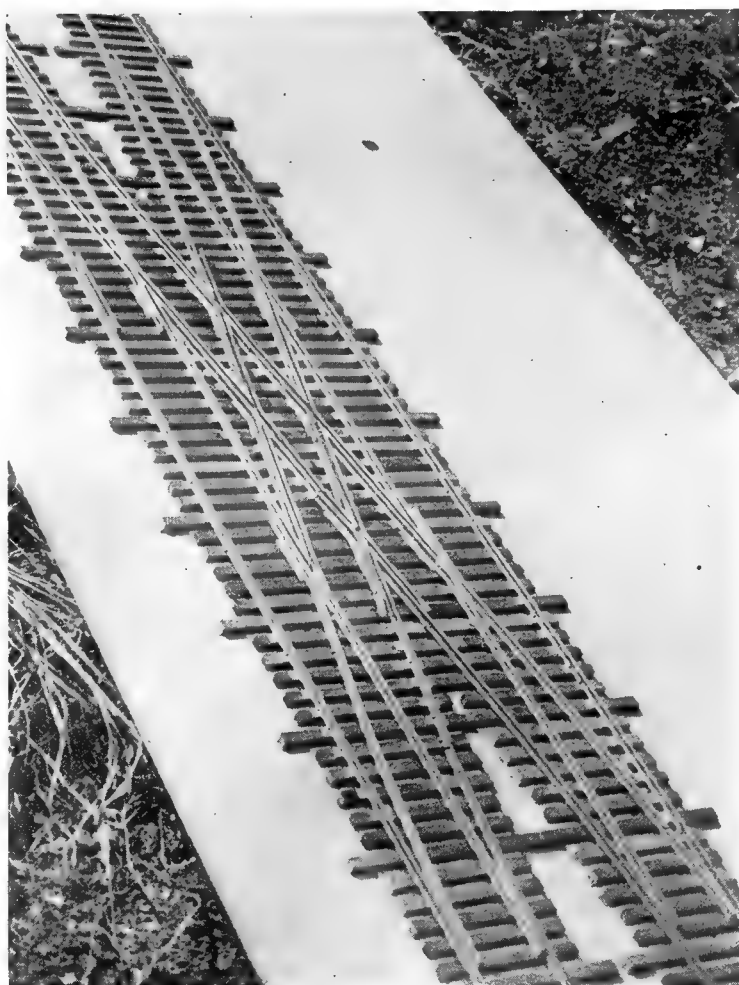
Lay out two tracks, using parallel center lines, and on these locate four turnout templates. With these templates it is easy to lay out a double crossover, as the various turnouts are merely pushed up or down on the center line until the lines representing the track match up at the intersection. With the templates glued in place to the baseboard, it is a simple matter to pick out ties of the proper length and glue them to the template. Next, lay one of the outside running rails and spike it in place directly over the track drawn on the template. Tieplates are available in O gauge and help materially to make the trackwork realistic in appearance. It takes a little while to put these tieplates in place before spiking, but a person becomes rather adept at the job after a few of them are installed.

The outside running rail of the opposite track is laid down next. For further identification, it is mentioned that these two rails installed are farthest apart, each being the outside rail of its track. Do not spike down these rails where guard rails or switch points are to be installed. If after the two rails have been laid it is found that they may need a little straightening, this can be accomplished by drifting the rail into the correct position by using a nail set and a hammer. If you feel that the rail has loosened up slightly in the process, it might be well to drive in another spike or two at the weak section.

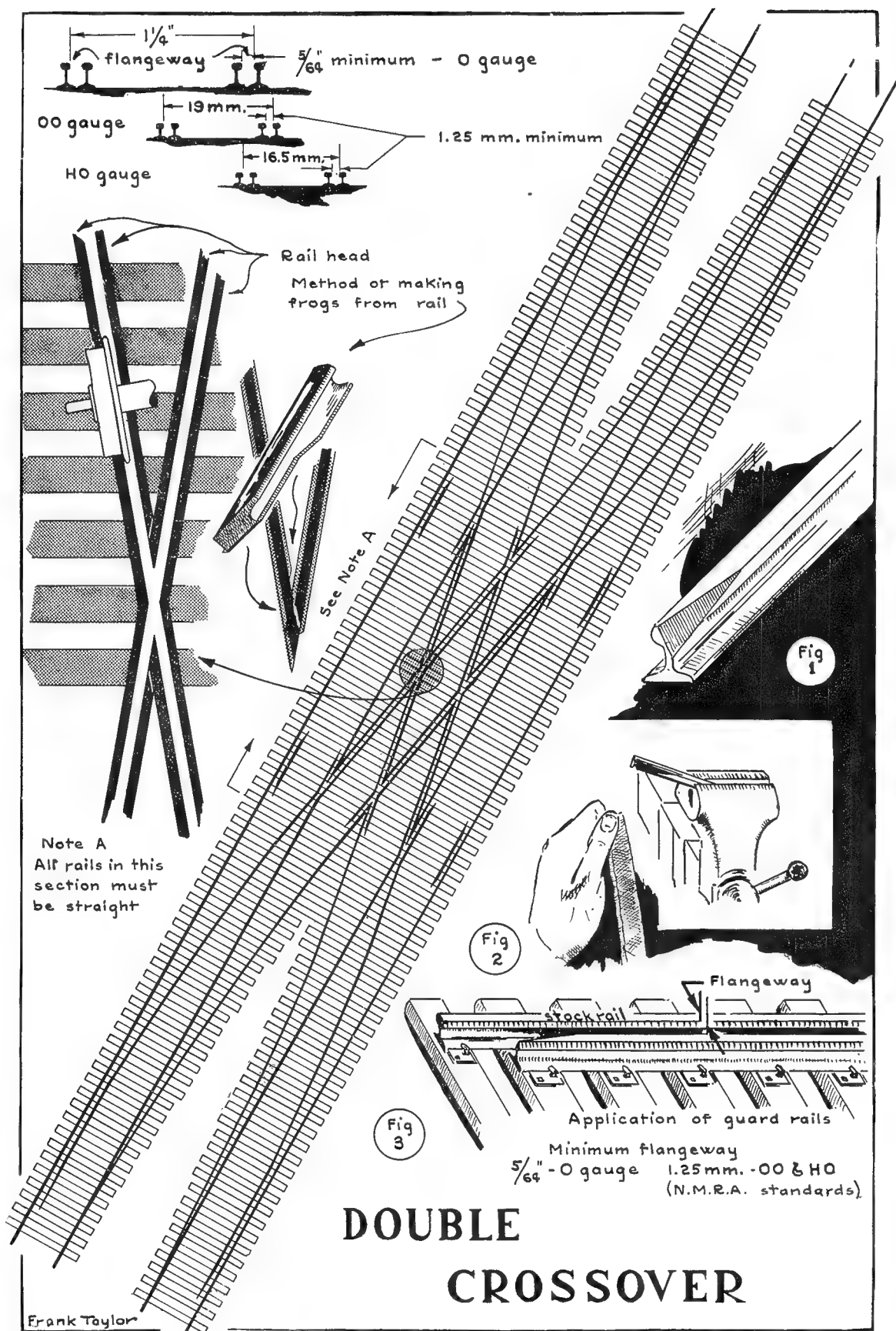
It will be necessary to build up four frogs for the turnouts.

Refer to the chapter on detailed track switches. This outlines the method of filing the rails and assembling them to make the frogs. The illustration on page 73 shows how a rail should be filed, in order that its mate will be able to form a tight joint against it. Notice that the base of the rail has been filed back considerably to allow the other rail to make contact at this point. The end of the rail must be filed at an angle, coincidental with that shown in the template. One rail should overlap the other as shown. After trying this method, those of you who have been filing both rails to fit side by side with the points matching will find that less filing is necessary and that you will be able to make a much better joint in less time.

After the filing and fitting has been taken care of, the rails are spiked directly over the template and then soldered. If you are using steel rails, be sure that the grease that is to be found coating the rails when you receive them from the manufacturer is cleaned off thoroughly. In fact, it would be a good idea to file, lightly, the surfaces



The finished double crossover.

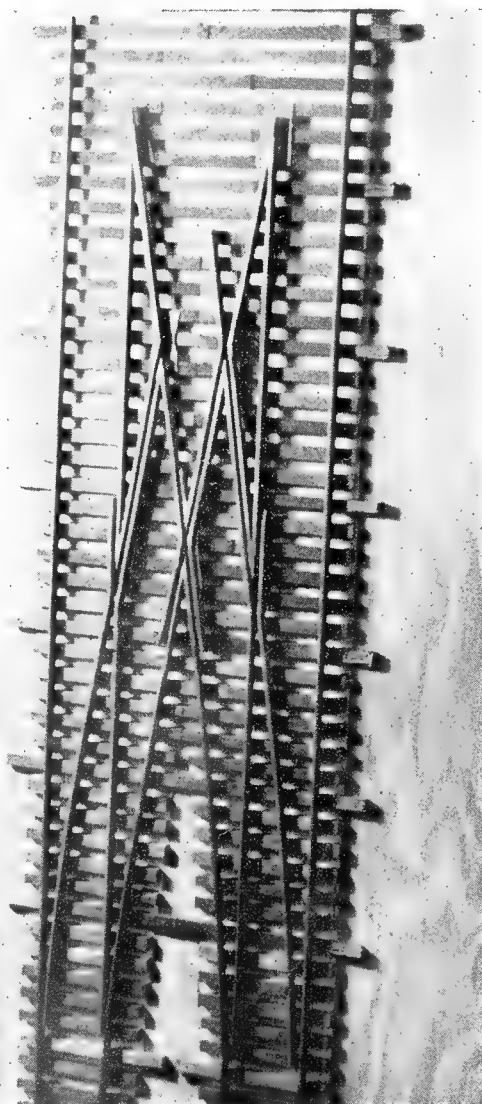


to be soldered in order to form a better solder joint. Hold the iron in one place and allow the melted solder to run down between the joints. This can be facilitated by applying some flux to the joint beneath the soldering iron tip while the iron is doing its work. Notice that the side of the frog that forms the inside rail of the straight track (the outside track, not the crossing track) can be connected directly to the other frog on the same track. Likewise, the rail of the frog that will form the crossing track will meet the other rail of the other frog at a point midway between the two frogs. In other words, the two turnout frogs on the same track can be assembled to form a triangle. This can be traced by studying the templates directly beneath the ties or by referring to the drawing.

The closure rails are prepared next. These are the rail sections between the ends of the movable points and the frogs. The frog ends of the rail are bent to form what are called wing rails. The length of the combined wing rail and closure rail can be determined from the templates. One of the closure rails is slightly curved. This curve, incidentally, is the only one to be found in the complete turnout. The rails through the frog and the switch parts are absolutely straight.

For a simple turnout, a wing rail would be included on each side of the frog point, but due to the fact that this turnout is part of the double crossover, the wing rail generating from the straight closure rail continues on toward the center, in between the two tracks. Spike these rails down temporarily, determining that the space between the two parallel rails is according to N. M. R. A. standards. Refer to the drawing for exact figures. The space between this extended wing rail and the running rail which forms a part of the frog proper is called the flangeway.

With this rail in place, mark off just where it should be cut in order to form part of the diamond network. The trackwork in the center of this mess is called a diamond because it is shaped somewhat like a diamond on a playing card. The inside stock rails of each main line track (I shall say for clarity) are laid next. These begin to curve toward the center at the point where the closure rails are installed, and they terminate at a point equidistant between the two main line tracks. Take care in marking off these rails for cutting so that sufficient material is available for the type of joint used in making the frog previously described. Unfortunately these rails must be lifted after they are marked, so the fastening is only temporary. It seems like much work wasted, but the method is the best to use.



Construction at the half-way stage.

Pick out a piece of brass or tinned sheet iron about the same thickness as the tie plates, and cut from it a plate to fit under each turnout frog. You will notice that four more plates are used in the construction of the diamond. First cut the plate to the approximate length shown and then slip it beneath the rails at the point where it is eventually to be installed. Then scribe a line, using the base of the rail as a guide, remove the material, and cut the plate slightly larger than the scribed line. This excess will form a slight shoulder and will allow you to solder the rail base to the plate when it is again placed in position. Solder can then be flowed down between the flangeways, the rail being heated to a point where the solder will flow freely between the bases of the rail, thus forming a strong joint.

As a further help, let it be said that the only reason frogs are used in a turnout is to enable a car wheel to cross a diverging rail. If frogs were not used derailments would surely occur.

Some of the operations and parts described heretofore are duplicated on both ends of the installation. What has been described and installed for the right hand turnouts should be duplicated in the left hand turnouts, etc. With this track in place you will notice that it is only necessary to install the diamond at the center and it will then be possible to run a pair of wheels over the complication.

You can follow these instructions and turn out a double crossover that is a failure if you do not bear in mind that above all things, you are striving to lay down a pair of tracks that cross like a pair of scissors and connect two parallel tracks. The main thing is to get the tracks that cross each other to line up straight. As these crossing tracks are made up of a multiplicity of small sections, your Waterloo can be met by filing the proper kind of joints and then failing to line up the various parts. They must be in gauge and they must be straight. Install the parts, keeping these two major fundamentals in mind. Use a straight edge, ruler, or what have you when alining the parts that form the trackwork. It is also important to keep the flangeways as close to N. M. R. A. standards as is possible. Never go under the measurements recommended. File off all excess solder that accrued when assembling the frogs.

The diamond is formed by cutting stock rail to appropriate length and filing the joints to fit, as was described in making the frogs. The supporting plates beneath each junction are then placed and soldered.

To make for smoother running, file all of the surfaces that will come in contact with the wheels and flanges. Get a file that is thin enough to fit between the flangeways and run it lightly over the edges of the rail. This will help tremendously to make a smooth crossing for the trains to operate over.

Four guard rails are installed directly opposite the turnout frogs. Refer to the photographs and the drawings. One of the sketches shows a way of shaping the guards and wing rails, which are, in effect, easements. See Fig. 1. They gradually constrict the direction of the wheels by controlling both the inside and the outside of the wheel flanges. This guard rail actually guards against the possibility of the wheels splitting the frog. Once the flange of the wheel has entered the flangeway between the guard rail and the stock rail it cannot help but go in the right direction.

As these guard rails are quite small in length, they are held in a vise so that the necessary shape can be formed on the guard rail end with a file. See Fig. 2.

The guard rails can be installed permanently by soldering the base of them to the base of the stock rails. One or two of the hold-down spikes can also be soldered to the rail for further solidity. Be sure to determine that the flangeway between these guard rails and the running rails is neither too wide nor too narrow. Refer to Fig. 3.

The various parts that make up the assembly can now be fastened permanently to the ties. If tie plates are to be used, these can be slipped in under the rails that are now temporarily spiked in position. It is best to slip eight or ten of them in place before doing any of the spiking. You will find that the commercial tie plate is not long enough to fit under both the running rail and the guard rail; the only answer is to cut the tie plate in half and slip these parts in place under the two rails. Even with this arrangement they will form sufficient support to provide a sturdy base for the trackwork. As quite a number of these will be used, it is sensible to cut perhaps 25 or 30 of them in half before laying the tinsnips down. Although you find four or five spike holes provided in the tie plates, it will only be necessary to use two spikes to hold the rail at each tie. You had better use the two catercorner holes when spiking, in order to prevent splitting the ties.

Four sets of switch points are prepared next. The length of the rail to form these points is determined by referring to the switch templates. In preparation, eight lengths of rail can be cut to this size. One end of each of these rails is filed to a point. Do all of the filing on the side of the rail that is to come in contact with the stock rail. This operation will give you four rail lengths filed on one side and four lengths filed on the opposite side, to form pairs.

Slip a fishplate half-way on to the closure rail and then press the blunt end of a switchpoint rail into the other half of the fishplate. The fishplate should be made to fit either the closure rail or the switchpoint rail rather loosely so that when it is in place it acts as a hinge and allows the switchpoint rail to move laterally. A good fit should ensue when the switchpoint rail is thrown against the stock rail. You will find that the bottom of the switchpoint rail will need to be filed at an angle so that it can be made to fit against the stock rail without climbing up on the base of it. Follow this procedure when fitting the other switchpoint rails.

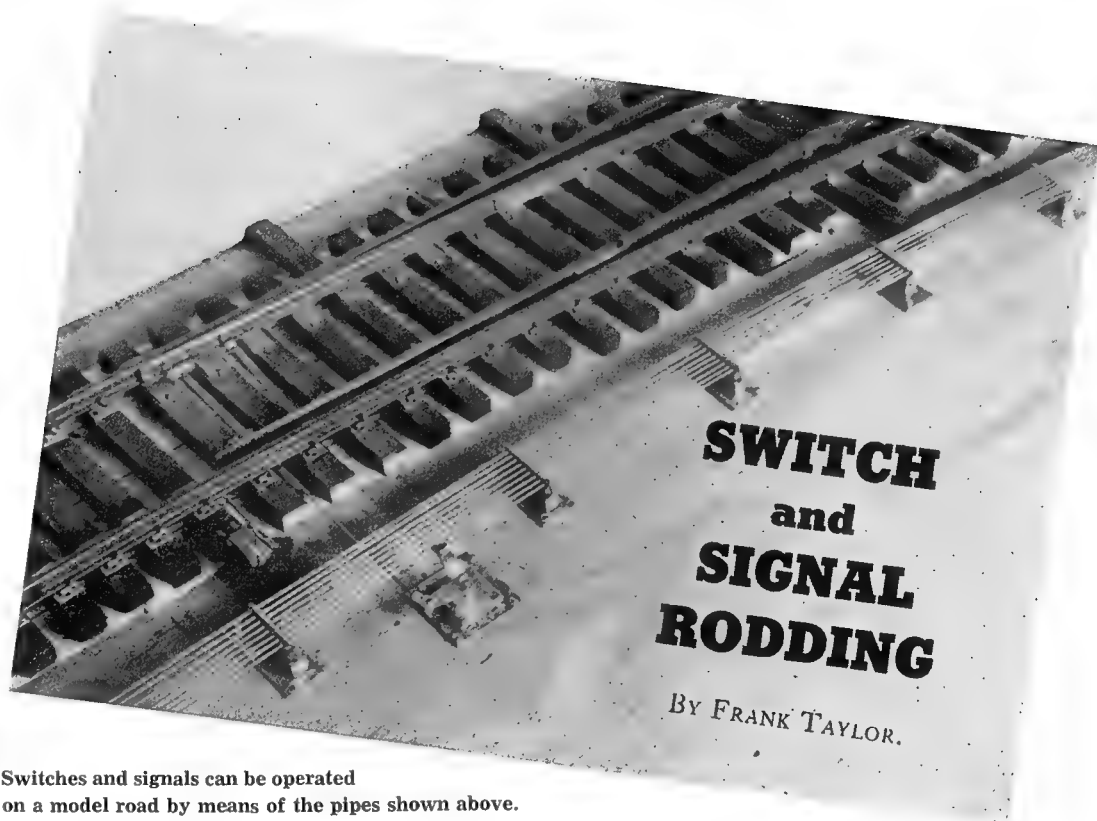
With these parts in place and in good working

order, a tie rod is made for each set of points. This tie rod, as the name implies, ties both of the switchpoint rails to a definite relationship and forces them to work in unison. The routine for making tie rods is outlined in the previous chapter on making a detailed switch.

There are several other ways of tying these switch points together that are practical even though they do not look quite so good. One of them is to use a piece of flat brass stock, soldering the points to it to form a solid joint. Fish-plates are again used for hingeing the points to the closure rails. With this method the tie rod travels in a slight arc as it is pushed one way or the other to manipulate the switch points. Another method is to use the same material, the only change being that the brass tie rod is hinged to the bottom of the switch point and is loosely riveted to the base of the rail with a pin or machine screw. A pin is most often used. The assembly of the tie rod and the switch point is made before they are finally placed. Depending upon the scheme of track insulation, it is occa-

sionally advisable to use a piece of bakelite for a tie rod. The method of assembly is virtually the same as if the brass tie rod were used. Using bakelite for a tie rod will prevent an electrical short circuit.

There is no reason why the switch points, closure rails, and frogs should be insulated from each other for two-rail operation. When the switch points are thrown for one direction it mechanically precludes the possibility of an electrical short because the opposite switch point is sufficiently far away from the rail. The reverse is also true, because when the switch point is thrown to contact this rail it opens the opposite switch point from the other running rail. If this hookup is used, be sure to check the points against the possibility of the wheels shorting. The space between the switch point and the running rail must be sufficiently wide to prevent this. It might even be necessary to enlarge the space beyond that shown on the template in order to make the switch trouble-free electrically.



Switches and signals can be operated on a model road by means of the pipes shown above.

THERE is a certain fascination to operating the switches and signals of a model railroad with a mechanical plant. The levers are thrown and the motion is carried through rodding (pipe, to be technical) to the switches or signals. This method is still in use at many points on real railroads in spite of the pneumatic, electric or electro-pneumatic systems of operation that are available today.

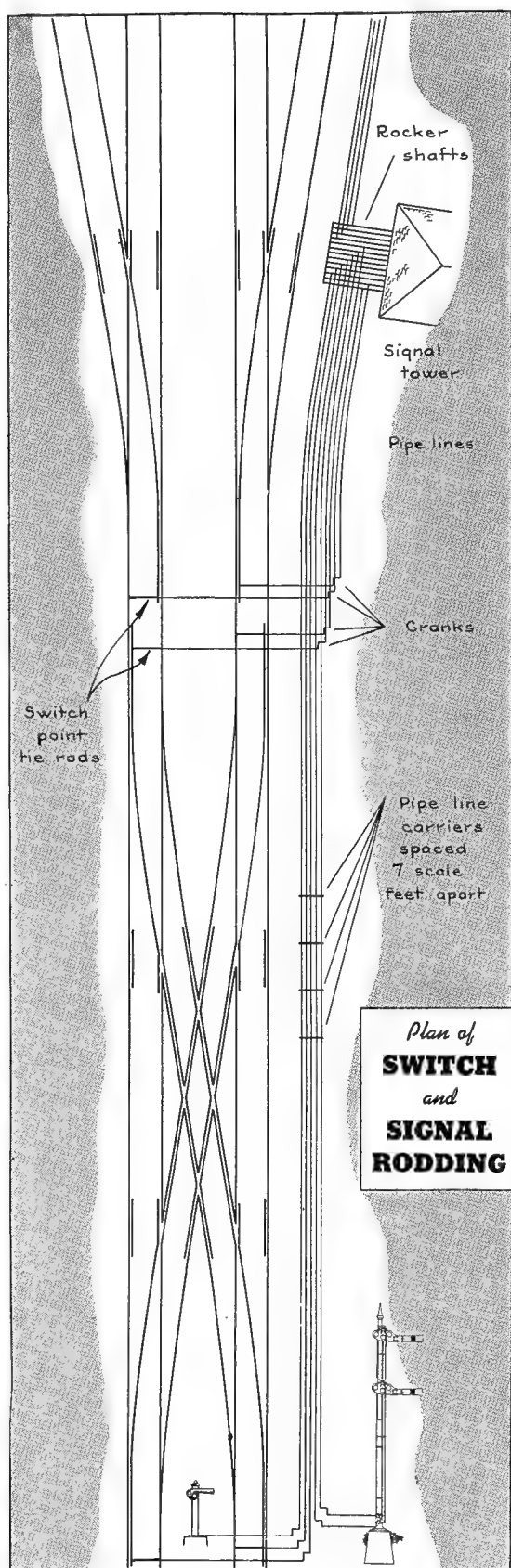
The mechanical method of locking the various levers was forerunner of the up-to-date all-electric system in which a multitude of relays and other electrical control apparatus are used. The mechanical interlocking tower is designed so that the tower man who operates the levers must follow a certain procedure of throwing levers in order to effect a change in track direction or signal position. In case a switch is to be thrown he first throws the lever which controls that operation, and that movement allows him to throw the derails which protect the switch. Those movements, in turn, allow him to change the signal. This performance must be followed in reverse order to break down the track arrangement.

Although nine out of ten model railroaders will be satisfied to connect their roddings directly to some form of lever that is mounted on their control panel, the foregoing information should be of general interest. The man who



Methods used in changing direction of pipes.

wants to go in for interlocking should refer back to an article on this subject in the December, 1940, issue of *THE MODEL RAILROADER*. A sketch showing a simple method of building an inter-



locking machine is shown on page 80. The various guides are made from 16 gauge strap iron, $\frac{1}{2}$ " wide. If a device like this is used the rodding can be connected directly to the locking bars.

The model railroader would do well to consider this means from a cost standpoint, too, because the various materials used are inexpensive as compared to electric switch machines. The pipes are mounted alongside the running rails as shown and are very accessible in case adjustments are to be made. The photograph at the top of page 77 shows how neatly the piping can be installed and a reference to A and B on page 79 will show how closely the pipe carriers can be modeled as to size. Some deviation in the parts that make up the pipe carrier are necessary due to the greatly reduced size, but you will find that the model pipe carrier shown in B looks realistic and is very practical.

The shape of the pipe carrier has been reduced to its simplest form and only four parts are used in the construction of one of these units. This is desirable because the pipe carriers are usually spaced about 7 scale feet apart on straightaway and this is changed to 6 scale feet at the curves. A plan along the side of this page gives a general idea as to how rodding is installed. Notice that as a rule the pipe farthest from the running rail is connected to a crank and then transversely to the switchpoint tie rod.

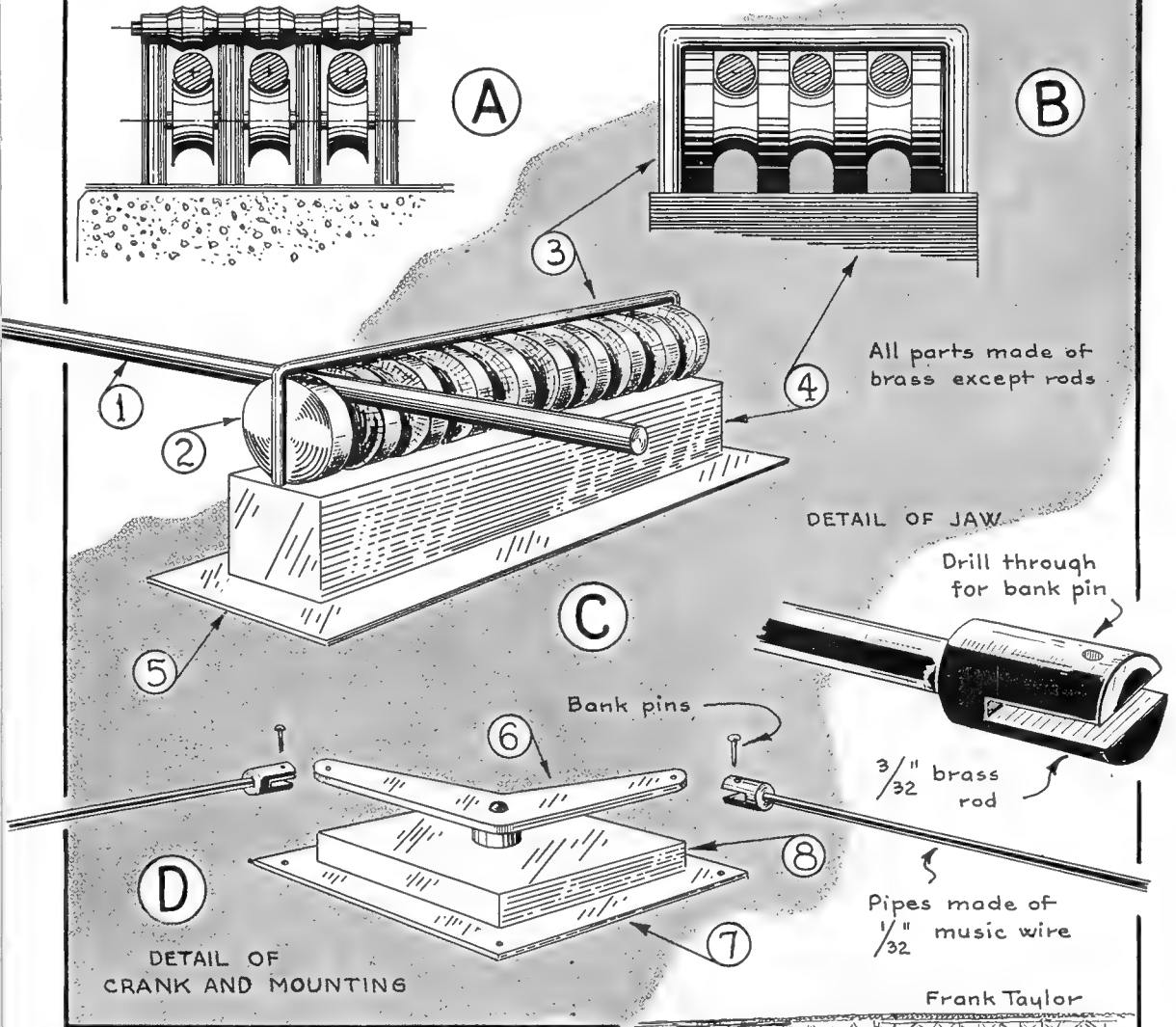
Reference to the sketch on page 81 will show that the clearance for the nearest pipe line is 4'-3" to the gauge line of the rail. Additional pipes mean more carriers and, incidentally, a larger pipe carrier mounting base. This base, depending upon its size, is taken into consideration when grading for drainage, etc. For mechanical reasons the pipe nearest to the running rails occasionally is cranked to a switch or signal. Whatever the reason, it does look neater to have the outside pipes connected up to the signals or switches nearest the interlocking tower and have the inside one continue without joggling to the very end of the controlled area.

In order to determine the number of pipe carriers to make, the locations of these should be determined on your layout, beginning at a point near the interlocking tower. An ordinary pin can be stuck in the baseboard to represent each pipe carrier, and with these in place you can more easily determine how many carriers should be made to support one rod, two rods, or whatever number the requirements may be. Refer to B on the next page once more. You will notice that the carrier shown is made to support three pipes and can be made from $\frac{3}{32}$ " round

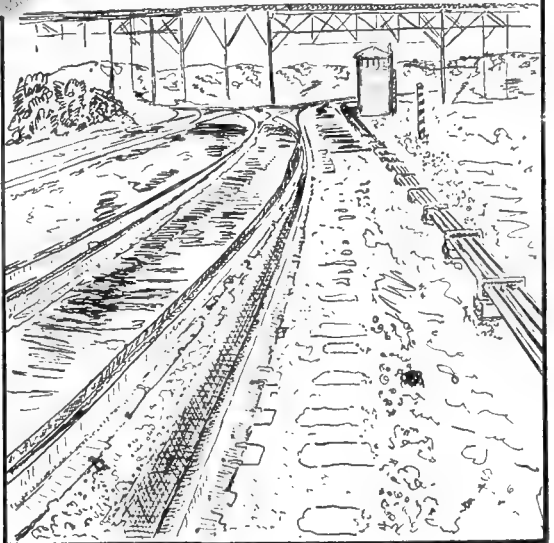
ANTI-FRICTION PIPE CARRIER

Prototype

Model



Frank Taylor



brass rod. The turning is ostensibly a lathe job but can be duplicated in another way by slipping small washers of the same over all diameter on a rod and soldering the various parts together. A spacer of some sort should be used when soldering if this procedure is followed. However, if you do not have a lathe it would be best to have a number of these turnings made up, and they can be cut off to the desired length. A lathe tool should be ground to the shape shown, slightly wider than the thickness of the wire used as pipes. The stock between each cut is about equal in width to the cut itself.

As there is considerable thrust placed upon the rods it is suggested that $\frac{1}{32}$ " diameter music wire be used. This wire can be obtained



Notice the offset jaw and crank mounting. An offset is often bent into one arm of the crank as an alternative.

in 2 ft. lengths at any hobby shop that handles model airplane supplies.

The parts referred to as 4 in drawing C are made up of $\frac{1}{8}$ " square brass rod. These are cut slightly longer than the turnings, 2. The next step is to solder the square brass piece to the turning. The two parts can be held together with a small battery clamp (such as is sold in radio stores) to facilitate soldering, and to save your fingers from being burned. A piece of round brass wire about .020" thick is bent into the form of a staple and soldered as shown in 3, sketches B and C.

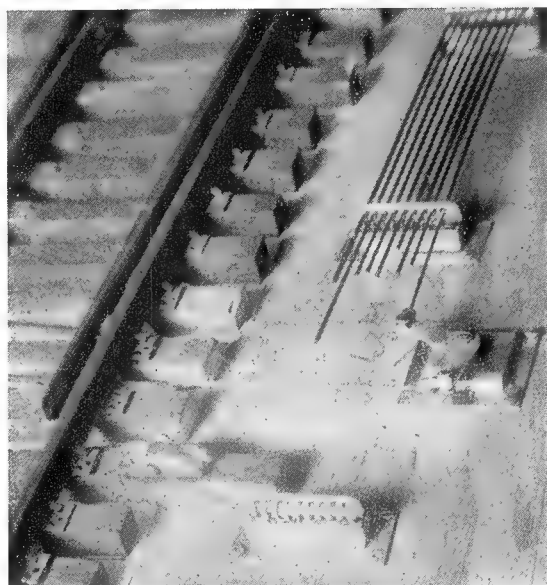
Next cut the necessary number of base plates, referred to as 5, from brass sheet stock or tinplate about .012" thick. Again use the battery clamps to advantage when soldering these plates to the $\frac{1}{8}$ " square brass sections. Except for the mounting holes the pipe carrier units are complete. Try a piece of rod, referred to as 1, through the pipe carrier as shown. If it is found that the pipe does not slide through each groove freely, select a drill slightly larger than the pipe and drill through the carrier at each groove for free movement of the rod. Nail the pipe carriers to the baseboard in the positions previously located, lining them up by first stringing them on one of the rods and then locating them the proper distance from the rail.

In actual practice, when laying out a pipe line the alinement is made as straight as is practicable, and when the pipe line follows a turnout or curve it is often the case to curve the line gradually rather than follow a rather sharply curved track, in order to avoid unnecessary friction.

The horizontal direction of a pipe line may be changed abruptly by using an angle crank. Angle cranks are most commonly used between the pipe line and the transverse pipe which is connected to the switchpoint tie rod. There is another device called a deflecting bar that is used in changing the direction of pipes. This is shown in the lower picture on page 77. A cursory glance will cause you to realize that this

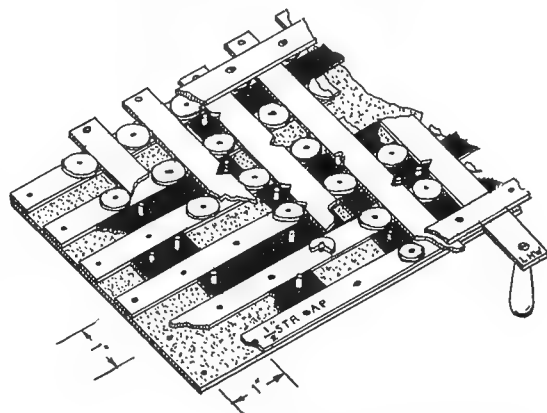
would be a hard device to model. Angle cranks should be used instead on the model pike.

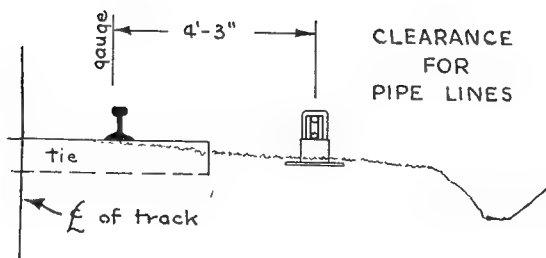
The angle crank and mounting are shown in sketch D. The crank is fashioned from $\frac{1}{32}$ " brass



The pipes are fed through the pipe carriers as shown.

sheet stock and the arms of the crank are made slightly out of scale in order that they will function properly. The distance between each of the three holes in the crank is about $\frac{1}{4}$ "





and the holes are drilled a working fit for bank pins. The arms of the crank are laid out at 90° , although larger and smaller angles are occasionally used.

A small washer is soldered to the bottom of each angle crank to provide clearance for the pins used at the end of the arms. This washer can be made by cutting off a section of $\frac{1}{8}$ " round rod and drilling through the center of it for a bank pin. The base, 8, can be made up in quantity to suit your needs, and if the pieces are made of $\frac{1}{16}$ " thick brass stock the crank arms will mount at about the right height for good operation. Fastening plates, 7, are made from .012" stock and are soldered to the base plates just referred to. Drill a hole through the center of the assembly for the bank pin and countersink from below. This provides a well for the solder. After the various parts are assembled and the bank pins pushed home and soldered, snip off the ends of the pins. Then drill the necessary holes for mounting the unit to the baseboard. After the ballast material has been applied the fastening plates and nail heads will be hidden from view.

The jaws used to connect the pipes to the angle cranks are simple to make. A piece of $\frac{3}{32}$ " round rod is slotted on one end with a hack saw as shown, and drilled on the other to receive

the rod, 1, which is soldered in place. A hole is then drilled through the jaw for the bank pin as shown. The hack saw will cut a slot just wide enough for a good working fit and no filing should be necessary.

Mount the cranks in position as shown in the photograph and connect up the various pipes. The bank pins used at the pivot points should be snipped off and soldered to the underside of the jaws. The transverse rods can be connected either to the switch points or to a semaphore signal. Methods of making switches and signals are treated elsewhere in this book and the connections to be made between the rods and this equipment are the same as the connections made at the angle cranks.

The equalizers or compensators illustrated on this page are installed at intervals along the pipe line to take care of the expansion and



Compensators used to counteract changes in length of pipe lines caused by differences in temperature.

contraction of the pipes caused by temperature changes. They are not necessary on a model railroad because such changes in pipe length are not encountered, or at least not to the extent that damage will result.

Some provision can be made to take care of the overthrow of a rod to avert undue pressure against the switch points or signal crank. A small spring slipped on the end of the switch tie rod and then soldered at both ends to the rod will do the trick. The transverse rod, ordinarily fastened solidly to the tie rod, is connected to the spring at about the center, which will allow the rod to travel farther than the throw of the switch without doing damage. A similar method can be used in making connections to the signals or other equipment on your model pike.



Rocker shafts used with interlocking machine tower.

TANK CARS

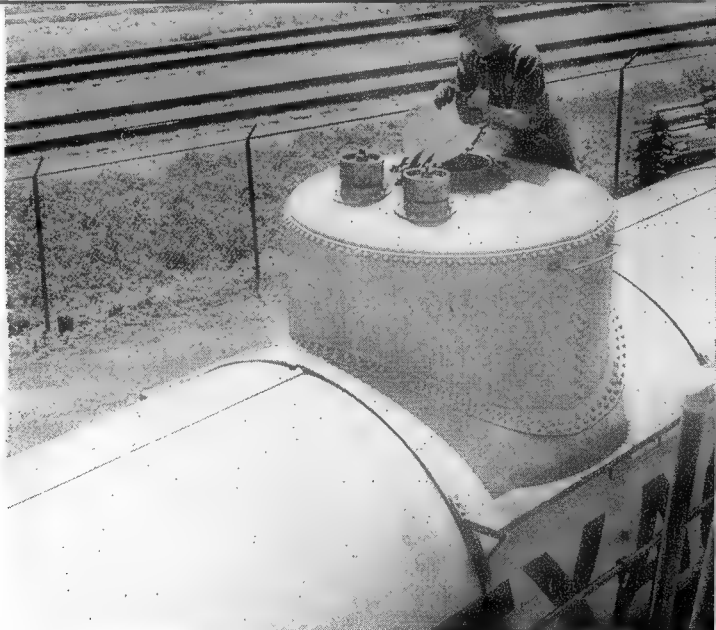
*Some Unique Methods Are Used
to Build a Detailed Car for
O, OO, or HO Gauge.*

ONE of the most interesting freight cars to model is a tank car of the I. C. C.-103 class. It is a general-purpose car and is used extensively for transporting oils and gasoline. This type of car has a riveted tank and dome equipped with a manhole and safety valves, a possibility for the man who likes detail. As the majority of these cars in use are privately owned, they are painted a galaxy of color combinations and many are especially lettered to attract the public's eye. From the modeler's angle this setup allows him to build a car that arouses comment, and what more can one ask?

To allow you to get off to a flying start in the construction of one of these cars, a list of materials has been made up for the three popular gauges, and a cursory glance will show that the list will be easy to fill. Most of the materials can be obtained locally, and items such as $\frac{1}{16}$ " x $\frac{1}{16}$ " brass ribbon can be obtained from model railroad manufacturers when ordering the brake wheel, brake cylinder, couplers and freight trucks. Dowels can be purchased from an upholsterer's or carpenter's shop, turned down on a lathe, or, as a last resort, they can be planed and sandpapered down to the correct diameter from a square strip of wood. Specify two-level Dalman freight trucks when ordering, with Betten-dorf trucks as a second choice in the event that the Dalman trucks are not available.

The first item on the list, a piece of brass .010" x 12" x 12", is used to make up the various tank plates and other parts of the car as shown in the drawings on the following pages. Tin-plate or the material from 5-gallon oil cans can be substituted without detrimental effect. In fact, tinplate will hold the paint better than brass stock.

Perhaps the most interesting part of the model to build is the tank and dome. With this in mind, lay out tank plates A and B as shown in the drawing on page 83. Detail can be added to these plates by forming a double row of rivets along the edges shown. Illustrated is a punch and die for forming the rivets that can be set up



in a small drill press selling for as little as \$1 at the various chain stores throughout the country.

Transfer the dome template to tank plate A as shown. A study of the drawings will show that the construction procedure is to use a dowel for the dome which will fit into the opening you

LIST OF MATERIALS for O gauge tank car

- | | |
|---|---|
| 1 piece brass .010" x 12" x 12" | 1 piece brass $\frac{1}{16}$ " x $\frac{1}{4}$ " x 22" |
| 1 piece pine $\frac{1}{4}$ " x $\frac{1}{4}$ " x 8 $\frac{3}{4}$ " | 1 piece brass $\frac{1}{16}$ " x $\frac{1}{16}$ " x 48" |
| 2 pieces pine $\frac{1}{4}$ " x $\frac{1}{4}$ " x 2 $\frac{3}{16}$ " | 1 piece brass $\frac{1}{16}$ " x 1" x 1" |
| 1 air brake cylinder | 1 hand brake wheel |
| 1 pair couplers | 1 pair freight trucks |
| 1 piece dowel $\frac{1}{8}$ " diameter x 2" | 1 piece dowel $1\frac{1}{2}$ " diameter x 2 $\frac{1}{2}$ " |
| 1 coil wire $\frac{1}{16}$ " diameter, 36" long | 1 piece wire $\frac{1}{16}$ " diameter, 6" long |
| 1 piece tubing $\frac{1}{8}$ " i.d., $\frac{3}{16}$ " o.d., x 2" long | 2 pieces dowel $1\frac{1}{8}$ " diameter x $1\frac{1}{2}$ " |

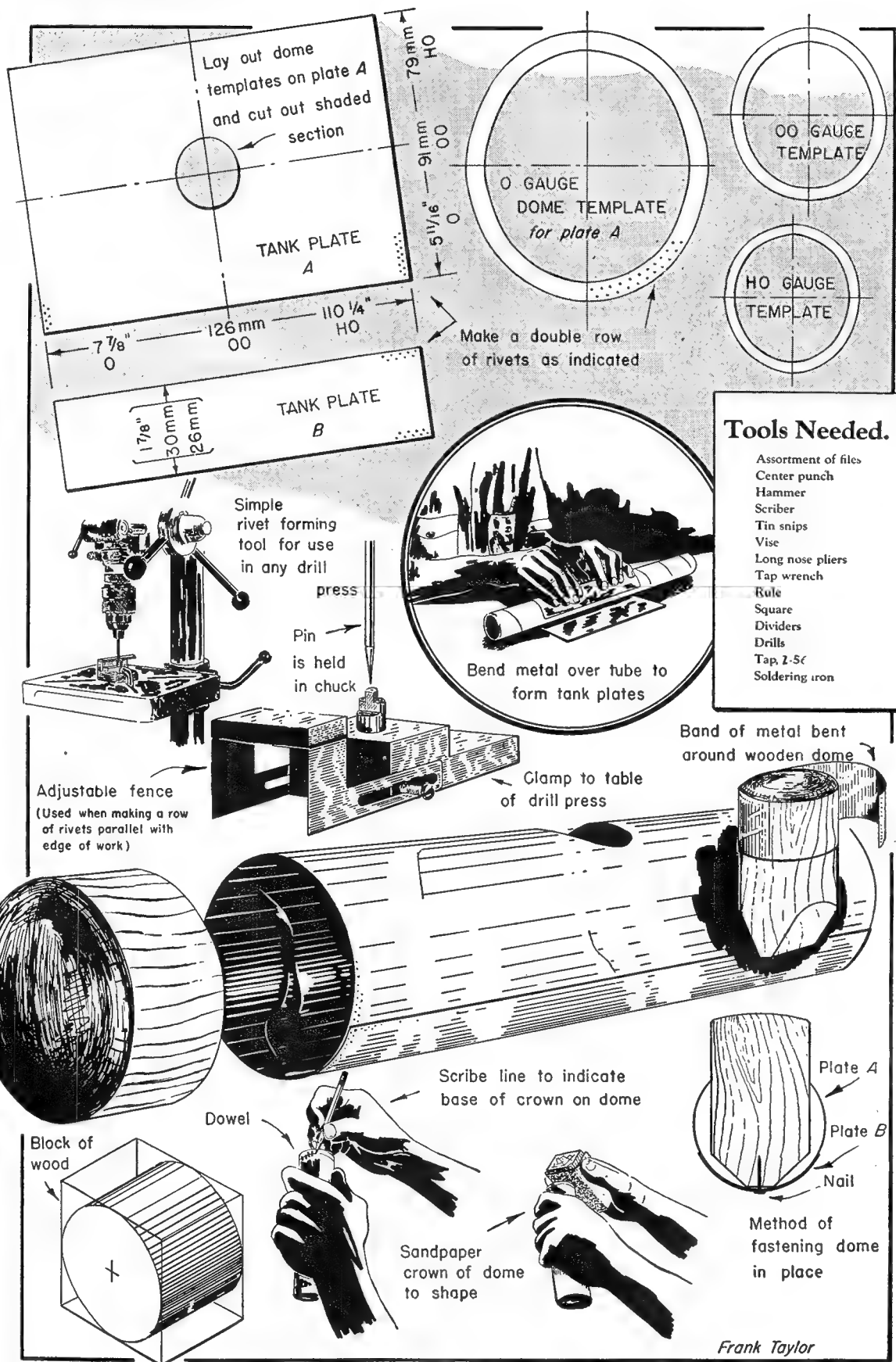
LIST OF MATERIALS for OO gauge tank car.

- | | |
|---|--|
| 1 piece brass .010" x 12" x 12" | 1 piece brass $\frac{1}{16}$ " x 1" x 1" |
| 1 piece pine $\frac{1}{16}$ " x $\frac{3}{16}$ " x 5 $\frac{1}{4}$ " | 1 coil wire No. 24, 36" long |
| 2 pieces pine $\frac{1}{16}$ " x $\frac{3}{16}$ " x 1 $\frac{1}{2}$ " | 1 piece wire No. 17, 6" long |
| 1 piece dowel $\frac{1}{8}$ " diameter x 2" | 1 hand brake wheel |
| 1 piece dowel $\frac{1}{8}$ " diameter x 1 $\frac{1}{4}$ " | 1 air brake cylinder |
| 2 pieces dowel $1\frac{1}{8}$ " diameter x 1" | 1 pair couplers |
| 1 piece brass .020" x $\frac{1}{16}$ " x 14 $\frac{1}{2}$ " | 1 pair freight trucks |
| 1 piece brass $\frac{1}{16}$ " x $\frac{1}{16}$ " x 36" | |

for HO gauge tank car

- | | |
|---|--|
| 1 piece brass .010" x 12" x 12" | 1 piece brass $\frac{1}{16}$ " x 1" x 1" |
| 1 piece pine $\frac{1}{16}$ " x $\frac{1}{16}$ " x 4 $\frac{1}{2}$ " | 1 piece wire No. 17, 6" long |
| 2 pieces pine $\frac{1}{16}$ " x $\frac{1}{16}$ " x 1 $\frac{1}{4}$ " | 1 coil wire No. 24, 36" long |
| 1 piece dowel $\frac{1}{8}$ " diameter x 2" | 1 hand brake wheel |
| 1 piece dowel $\frac{1}{8}$ " diameter x 1 $\frac{1}{2}$ " | 1 air brake cylinder |
| 2 pieces dowel 1" diameter x 1" | 1 pair couplers |
| 1 piece brass .020" x $\frac{1}{16}$ " x 13" | 1 pair freight trucks |
| 1 piece brass $\frac{1}{16}$ " x $\frac{1}{16}$ " x 36" | |

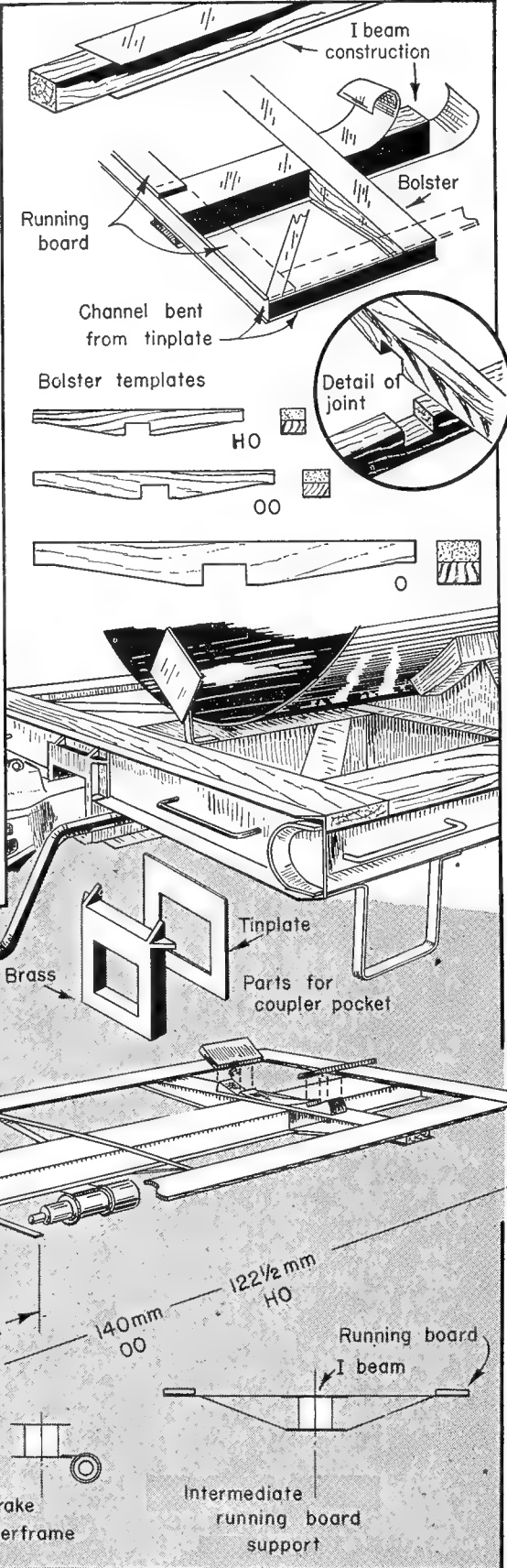
See tool list on next page.



just laid out on plate A. However, there is another way of modeling the dome, and that is to use the same dowel but rather than fitting it into the tank proper it can be shaped to put on top of the tank, much the same as a rider straddles a horse. Fastening the dome this way will allow the flange at its bottom to be made like the dome template on page 83 with the exception that a hole through its center will not be necessary because the dome will rest on the plate rather than pass through it.

There are a number of advantages to installing the dome as shown. The dome is easily located in the correct position because its base can be shifted around before the nail is driven in place. It is a bit difficult to shape a dome to fit the top of the tank as the other method would require. Notice that with the method suggested on page 83, a band of metal incorporating quite a bit of rivet detail can be bent around the wooden dome and mounted in place without having tediously to fit it to the shape of the tank proper. As there are but these two ways of making the dome, the highlights of the construction of each have been touched so that you can choose between them and know what to expect in the way of work involved and the effects created.

Tank plates A and B are rolled over a tube until the proper shape is created. See the drawing on page 83. It might be necessary to use a smaller tube than the diameter of the tank, because the metal has a tendency to spring back



a bit, and over-bending will counteract this tendency. When assembling the tank see that the edges of plate A butt up against each other, and that plate B overlaps this joint. Also, center plate B on the joint of plate A.

Notice that the methods of forming the tank head and the crown of the dome are identical. In each case a line is scribed to indicate the beginning of the crown as shown in the illustration, after which the dome is sandpapered to shape, using the scribed line as a guide. If a lathe is handy, turning the dome and tank ends is simplicity itself. Fit and fasten the dome in place first and then insert the two wood plugs that form the ends of the tanks.

Now is the easiest time to paint and letter the tank because after the straps, hand rail, and ladder are assembled they considerably complicate this operation. However, if you intend to apply decals or lettering transfers, as they are sometimes called, the painting can be done just as well after the car has been completed.

Construction of the underframe for the various scales is virtually the same. To make the explanation as simple as possible, construction of the O gauge frame will be discussed. If you are making one of the smaller models, follow the same procedure, using the materials suggested in your list.

The $\frac{1}{4}$ " x $\frac{1}{4}$ " x $8\frac{3}{4}$ " piece of pine forms the nucleus of the frame and the two $\frac{1}{4}$ " x $\frac{1}{4}$ " x $2\frac{3}{16}$ " pieces of pine are shaped and notched to form the bolsters. The centers of these are located $1\frac{1}{8}$ " from the ends of the center piece. On page 84 you will find templates for these bolsters and a detail sketch of the joint. Use model airplane glue to hold the various wood parts together. The other steps in the construction of the underframe are also shown.

The next step is to cut two strips of tinfoil and nail them to the center beam, thus obtaining a channel effect. A strip of tinfoil is fas-

tened to the top and bottom of the bolster as shown. This strip can also be soldered to the center beams.

Next, form the channels, which are also shown on the drawings and are used to box in the ends of the underframe. Solder a piece of tinfoil to a piece of $\frac{1}{8}$ " thick brass and then bend up the tinfoil around this material, hammering with a piece of lead to obtain a nice square corner. Then unsolder the tinfoil and file the two edges of the now formed channel to the shape shown. The channel on the end of the car is slightly wider than the one just mentioned, and a thicker piece of brass should be used over which to form the channel. For the smaller scales use proportionately smaller stock to form the channels.

File a recess in the underframe for the coupler as shown on page 84, after which the running boards can be installed. The $\frac{1}{32}$ " x $\frac{1}{4}$ " x 22" piece of brass material is cut to the proper lengths and fitted in place as shown. Solder the running board to the bolsters and any other metal parts coming in contact for further rigidity.

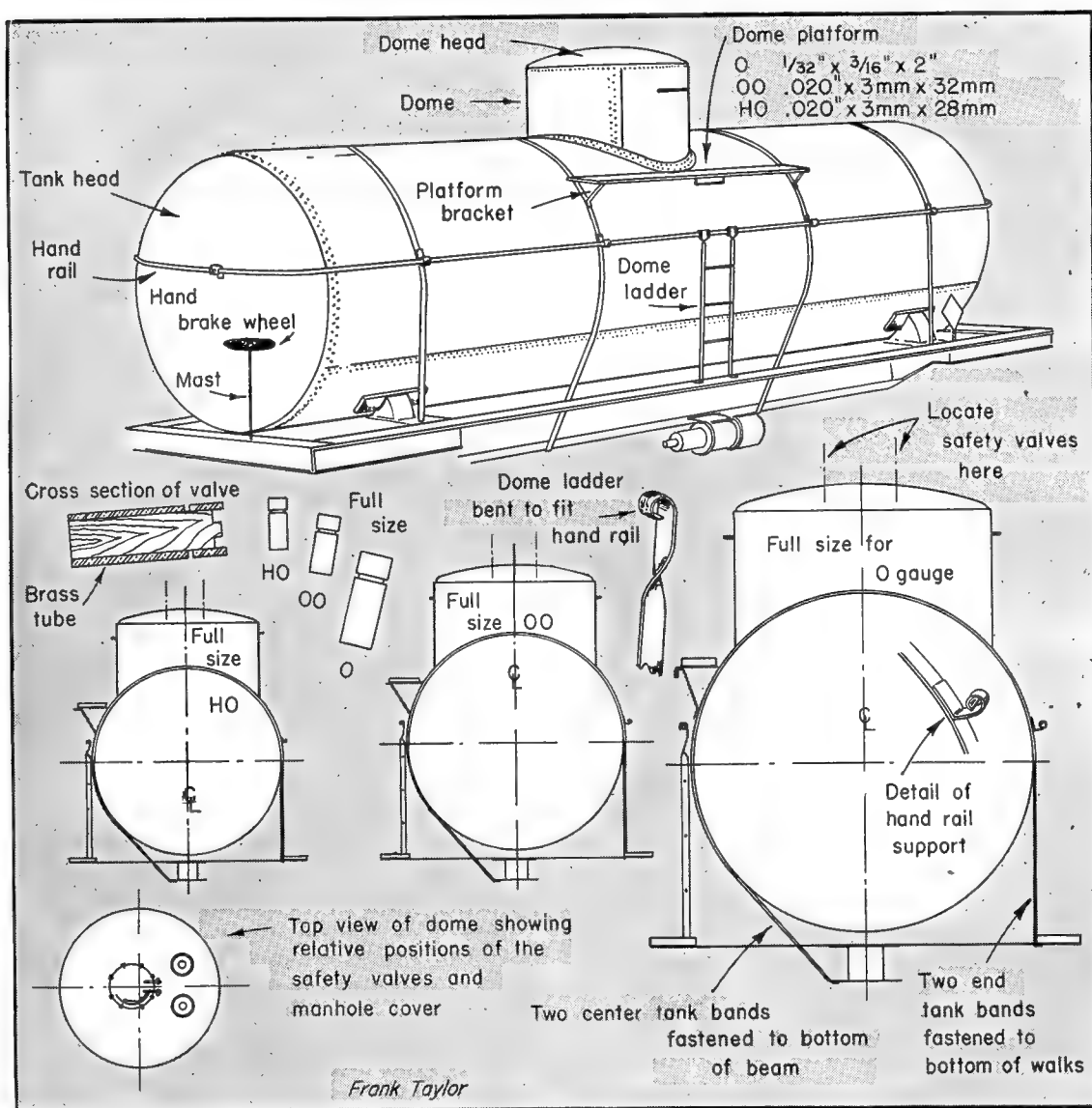
The $\frac{1}{16}$ " x 1" x 1" piece of brass is used, in part, to make the coupler pockets along with a piece of tinfoil to back it up for further detail. Refer to the drawing which shows the end channel notched to take these parts. Solder in place. The coupler pockets shown in the same perspective drawing are formed in the end of a second strip of tinfoil previously snipped from the large sheet. Solder the curved piece to the channel and then snip off the excess, which up to this time has been used for holding purposes. Make a coupler pocket for each corner of the car.

The grab irons are bent from round brass wire, inserted in the holes previously drilled, and soldered from the inside to save cleaning up the excess solder. The tank saddles shown on the same drawing are made up from either brass or wood. Notice that only one-half of the saddle is shown and that the upper corners of this saddle are notched for the tank slabbing. The tank saddles are either nailed or soldered in place and the tank slabbing likewise, depending upon whether you have made them of wood or metal.

The intermediate running board supports are located $3\frac{3}{8}$ " from the end of the underbody frame and are formed from $\frac{1}{64}$ " x $\frac{1}{16}$ " brass stock. These



Location of lettering is shown above.



are bent as shown and soldered in place. The air brake cylinder is fastened to the underframe in the position shown. Some variation in the method might be necessary, depending upon the style of lug provided by the manufacturer.

Mount the assembled tank on the underframe, and fasten it in place by soldering the tank to the saddles.

The drawing on this page indicates the position of the straps which hold the tank in place. Use the $\frac{1}{64}'' \times \frac{1}{16}''$ brass ribbon stock for this purpose. The two center bands are fastened to the base of the underframe and the two end bands are bent under the running board and soldered either to the running board or the bolster.

Locate the dome platforms and fasten them to the two center bands, using the platform

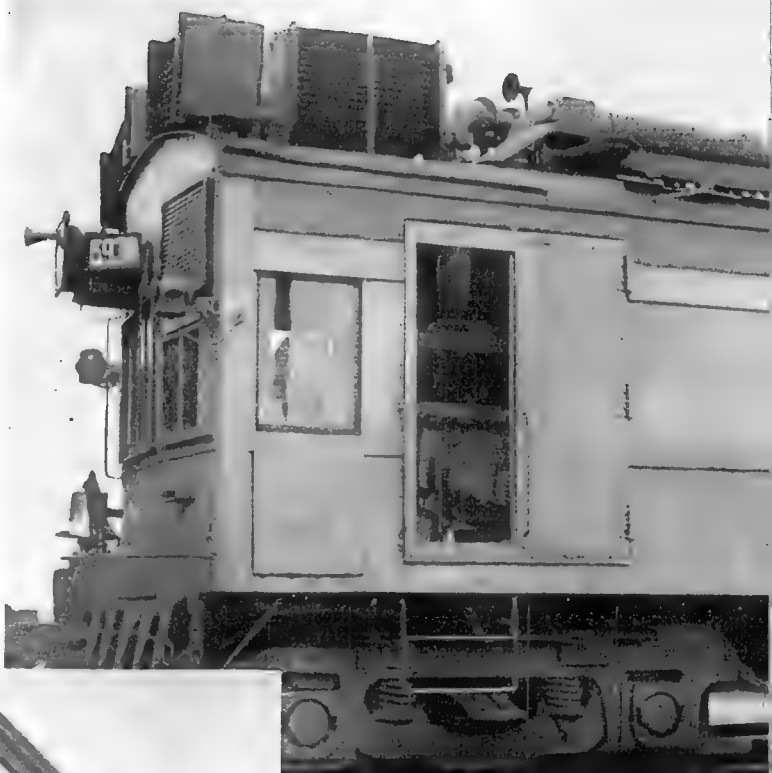
brackets as illustrated. The hand rail is bent up and fastened to the four tank bands and to the end of the dome with strap fastenings as shown in the thumbnail sketch. Attach a ladder to each side of the car, using the construction methods suggested. This ladder can be built up from $\frac{1}{64}'' \times \frac{1}{16}''$ brass stock, using pins for rungs, or a commercial ladder can be purchased and attached. The hand brake wheel is soldered to a length of wire which in turn is attached to the end walk on the same side of the car on which the air brake cylinder is located. Add the grab irons, manhole, and stirrup steps to finish the construction.

Transfers for a number of different tank cars can be purchased from your hobby store or direct from the manufacturer. If possible, have the model spray-painted.

CONSTRUCTION OF A GAS-ELECTRIC CAR

*Here's a Simple and Efficient
Power Unit for Your Railroad.*

Right: View of the left front of the prototype. Notice the large motor room door.



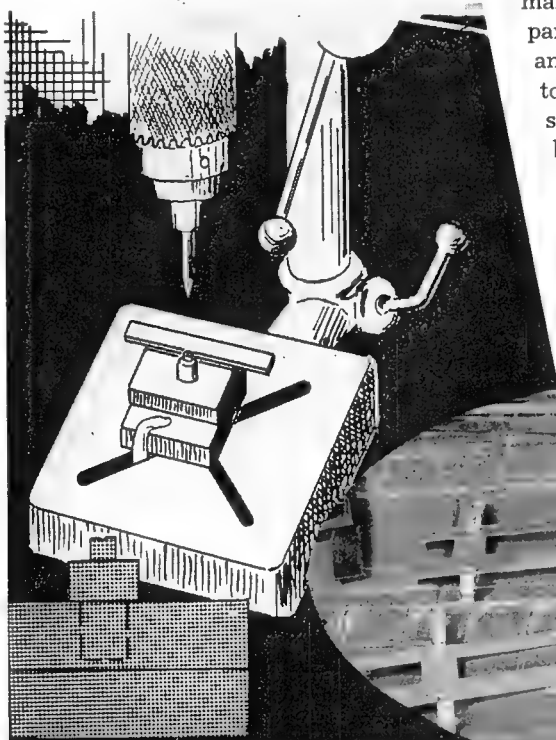
Assembly of rear doors, platform and end plates. View shows the platform as it is soldered to the end plate.

A GAS-ELECTRIC motor car is a class of equipment designed especially for short hauls and branch line service. The car is constructed on the same lines as an ordinary passenger car, and the installation of a power unit permits the car to run by itself. This is very desirable to the model railroader because in building one he acquires a piece of motive power combined with baggage and coach facilities—a complete train, in fact, in a short space of time. An O gauge car can be built directly from the articles, or HO or OO by rescaling from the $\frac{1}{8}$ " and $\frac{1}{4}$ " scale prototype drawings.

To make the model as illustrated, buy a piece of tin sheet iron from your local tinsmith. This will cost you about 40 cents and will suffice. While you are at his shop, have him cut up the sheet into various widths on his cutter. Three pieces $\frac{7}{16}$ " wide and about 18"

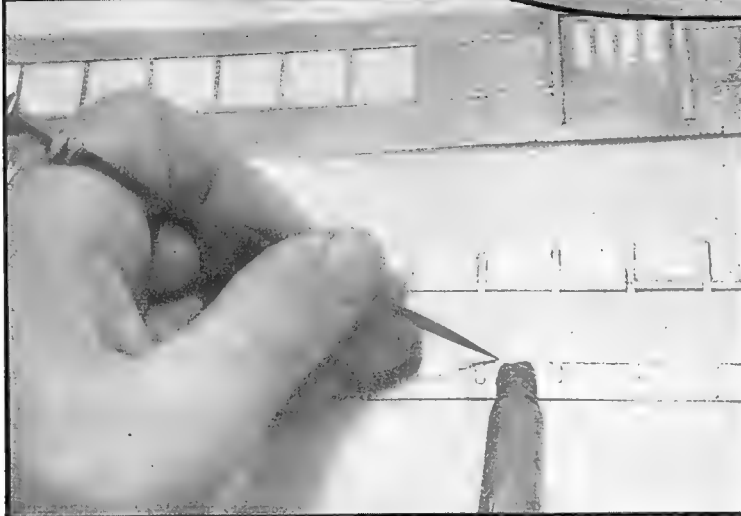
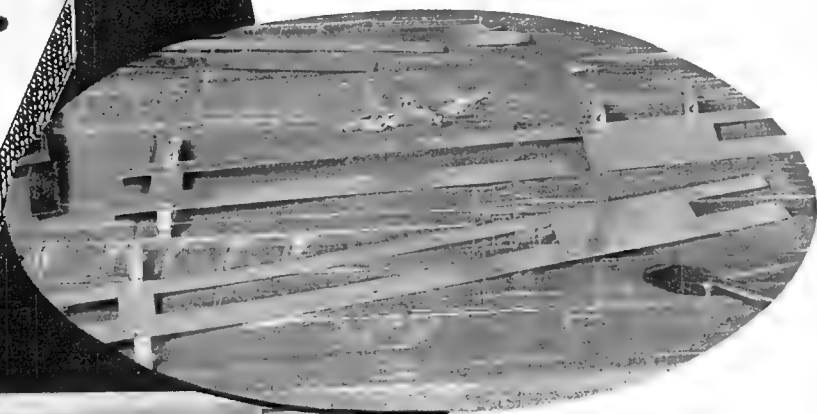
A series of shots overlapping to show the details of the car from one end to the other.

Rivet-forming tool and guide in the drill press.



long will be needed for letterboard panels above the window. The third one is just a spare in case you make a mistake on either of the two to be used. The panels beneath the window should be cut $1\frac{1}{16}$ " wide and 18" long. A piece $1\frac{7}{8}$ " wide and 18" long will do to make the baggage and motor room compartment sides. Four or five strips $\frac{1}{8}$ " wide, the same number $\frac{1}{16}$ " wide, and a single strip $\frac{3}{16}$ " wide will also be handy. If his machine will not cut strips this narrow ($\frac{1}{16}$ " and $\frac{1}{8}$ "") you can obtain this material from either Patterson Bros., Modelmaking Dept., 27 Park Row, New York, N. Y., or W. K. Walthers, 231 E. Erie St., Milwaukee, Wis.

The first step is to lay out the position of the



doors and windows on both the $\frac{7}{16}$ " wide letterboard strips and on the $1\frac{1}{16}$ " wide panel that is used below the windows. These two pieces are cut to length, which is computed by measuring directly from the half size prototype drawing. The strip measuring $1\frac{7}{8}$ " wide is now hauled out of the pile and two pieces are cut to fit between the engine room doors and the bag-

Oval: Assembly of the car sides.
Left: Method of soldering the window framing to the side pieces.



is baggage-mail combination belongs to the same series as the baggage-coach described.

gage doors. Two more pieces are cut to form the panels between the windows and the baggage doors.

These various parts are clamped, using small battery clamps as shown, or they can be soldered together lightly. Use a square at the front end to satisfy yourself that the parts are square with each other. The parts are assembled so that the $1\frac{1}{8}$ " wide panels are beneath the two narrow strips that form the top and the bottom of the window openings. One assembly should be a right and the other one a left. This is important. With these parts in place it is easy to lay out the location of the various rivets, as shown in the side elevations. Obviously, the parts will need to be taken apart to form the rivets at the right places, due to the several thicknesses of metal that are involved at certain spots. With this in mind, lay out the location of the splice plates between door bottoms. Refer to Figs. 3 and 4 before starting to put in the rivets.

The rivet-forming tool shown on page 88 is simple, and close scrutiny will show how it operates. Your attention is called to the guide strip that is to be seen directly behind the die or lower part of the rivet-forming tool. This strip is moved to a second location in forming the double row of rivets along the bottom of the car sides. It will not be necessary to form rivets in a section that is to be covered with a splice plate, for example. The rivets should stop at that point on the car side, but should be continued on in the fish plate (Fig. 3) so that after it is soldered in place the line of rivets is continuous.

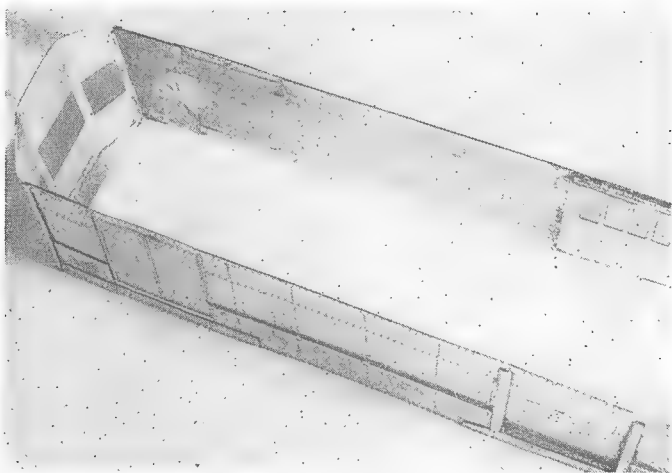
Next, reassemble the parts and solder them together permanently. Knowing just where the parts will come in contact with each other, it is suggested that these surfaces be given a light coat of solder and then be sweated together.

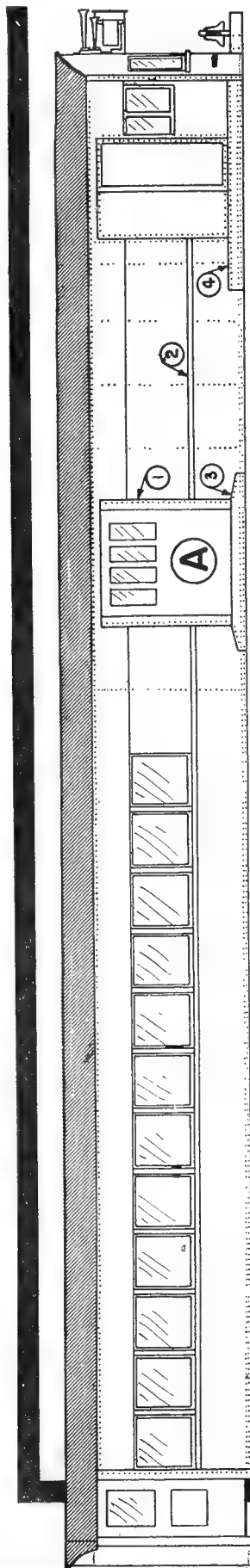
Lay out the window openings on the back side of each assembly. Cut 24 pieces, each about $\frac{1}{8}$ " long, from the $\frac{1}{16}$ " wide strip you have in stock. These are soldered in place to form the window openings. Separate pieces are then soldered between these strips and flush with the openings as shown on page 88. The next operation is to make two window material retainers as shown in D, page 90. These strips should be longer than the total window arrangement (Fig. 6). Four of them are necessary, two for below the window openings and two for on top. Notice that one edge of each retainer also forms a part of the sash. Again refer to D. The bent-up strips not only act as retainers for the window material, but also stiffen the car sides.

The $\frac{1}{8}$ " strip is now cut to length so that the pieces will just fit between the window retainers. See Fig. 7. These $\frac{1}{8}$ " strips are centered and soldered directly on the $\frac{1}{16}$ " pieces and finish the formation of the window sash material.

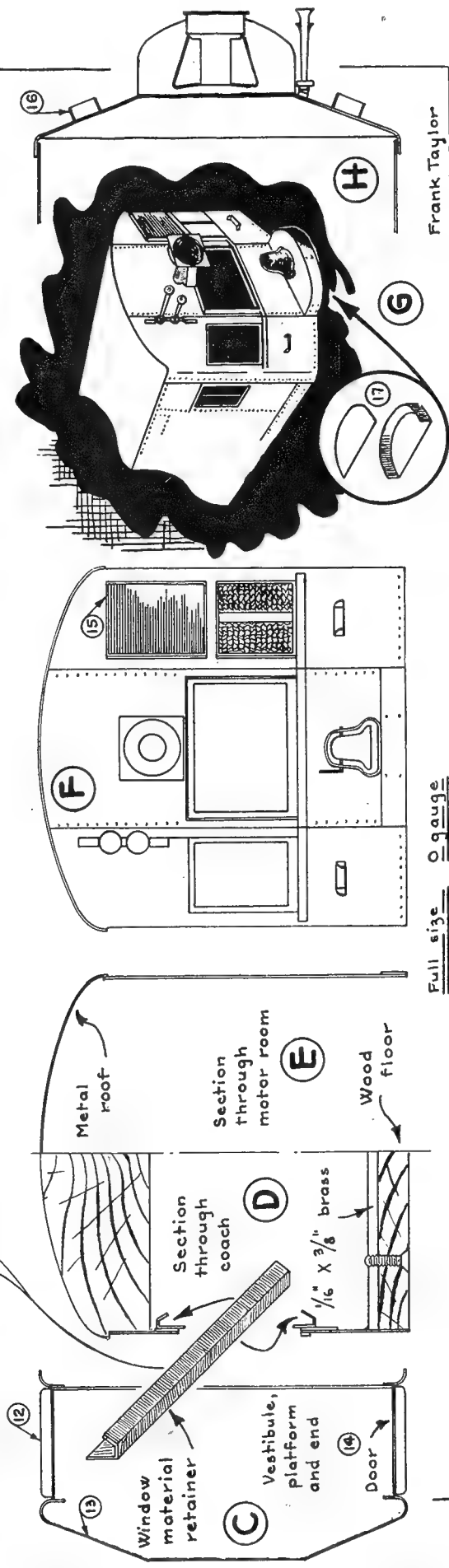
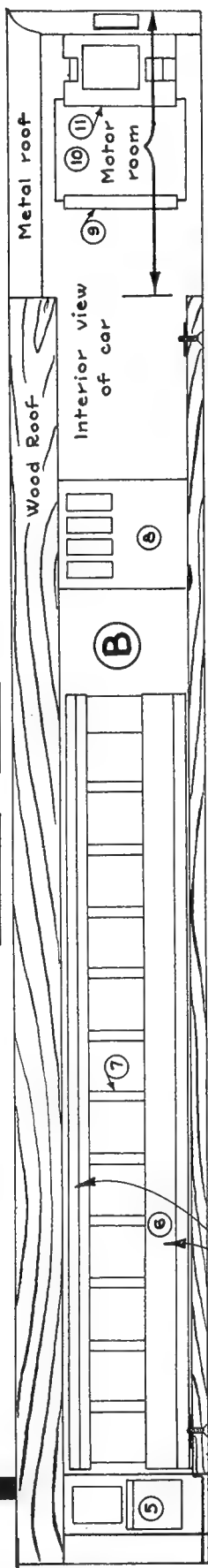
Cut the door openings up into the letterboard as shown in A, page 90, and also down to the splice plates, Figs. 3 and 4. Refer to the same drawing and make four pieces like Fig. 1. To round these pieces use a piece of $\frac{1}{8}$ " diameter

Below: Assembly of the sides to the front end of the car.





Half size O gauge



Full size O gauge

rod for a core. Clamp the rod and an oversize length of flat stock in the vise and bend the stock over the rods while they are held in place. After the bending operation the piece can be laid out as to width and cut to size. Press one of the edges against the guide on the rivet former for locating the row of rivets. Next solder the pieces in position as shown. Notice that two more rounded pieces can be made for the rear end of the car sides. These are soldered in place now.

The baggage doors (Fig. 8) and engine room doors (Fig. 10) are pieces of flat stock cut to fit the openings and are then soldered in place. Lay out the windows of the baggage door. Remove most of the metal by drilling and then file to the scribed lines with a fine-cut file. Nicholson 4" swiss pattern files are ideal for this sort of work. Scribe deep lines on the engine room door to give an illusion of the small door.

Form the window between the engine room door and the front of the car in much the same manner as the other windows were made. The sash piece (Fig. 11) can be made of one piece and drilled and filed out to shape if desired. This will allow you to cut notches in the top and bottom edges of the sash piece and bend the sections over to form window retainers as shown in elevation B, page 90.

Lay out the front end of the car, using the full size drawings *F* and *H* as a guide. The windows in this case are filed out to the scribed lines and the sash pieces are made as illustrated in Fig. 11.

Scribe lines to indicate exactly where the metal is to be bent in forming the end. The bend at each side of the center window can be made in a vise by lining up the scribed mark with the top of the jaws and then pushing over the projecting part with a block of wood. This method will make these bends smooth and even. The bends at the corners are done in the same manner. Be careful to make these in the correct place, otherwise the car will be too narrow or too wide, as the case may be. Also, refer to the photographs at the bottom of page 89, and you will notice that a piece of $\frac{1}{16}$ " x $\frac{1}{4}$ " brass was formed and soldered to the bottom edge of the bent piece. The angle of this piece was determined by referring to *H*. Solder the plate flush with the bottom edge of the car end. Form the necessary rivets on the end piece before soldering any of the pieces to it.

The belt rail on the sides and front of the car is made from $\frac{1}{16}$ " strips, soldered in position.

With these details taken care of, the two sides of the car can be soldered to the front end assembly. Be sure everything is true and square.

For further ease of handling, lay out the location of the wood roof and then shape the piece of

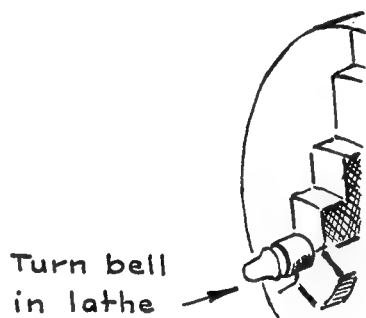


Fig. 17.

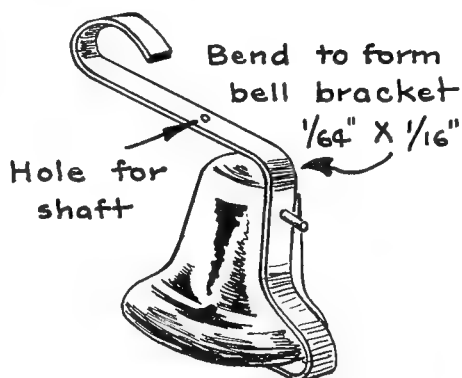


Fig. 18.

Headlight turning

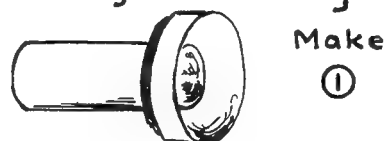


Fig. 19.

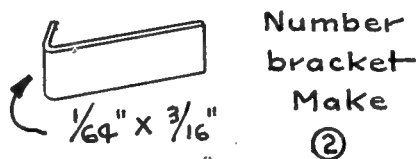
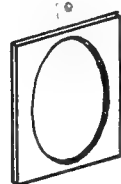


Fig. 20.

Faceplate of headlight



Make ①

Fig. 21.

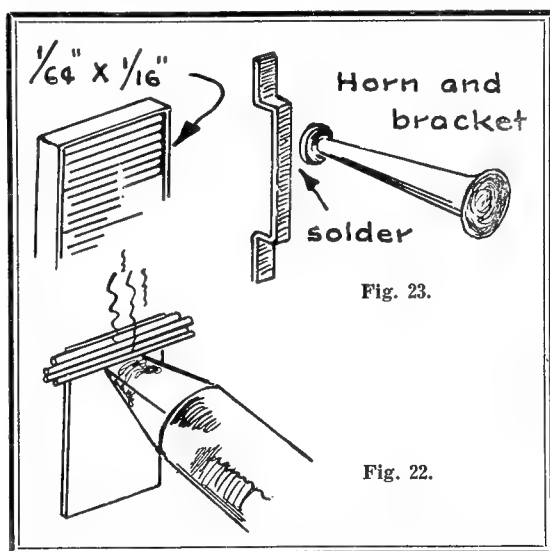


Fig. 23.

Fig. 22.

pine to conform to the shape shown in section D. Use a wood plane, follow up with a file, and finish with a course of fine sandpaper. A few bank pins through the side of the car will hold the roof in proper location. Check the contour of the front end against the contour of the wood roof for any error that may have crept in. Next, shape a section of metal roof to cover the motor room section. Refer to elevation B. The wood section can be used as a former when shaping the metal roof. Solder to the sides and to the ends from the inside. This metal roof should overhang the car by $\frac{1}{16}''$ for proper effect.

A vestibule, platform and end assembly as pictured at the bottom of page 87 and also drawn to full scale in C on page 90 is put together next. Lay out the end (Fig. 13) in exactly the same way as the front end was made, with the exception that the corners of the car should be made around $\frac{1}{8}''$ diameter rod instead of being bent in the vise, as was done with the front end. The platform is laid out on thin sheet stock from drawing C and soldered to the end. Do not solder this platform flush with the bottom edge of the end, but raise it up as shown in elevation A. Fig. 12 is part of the platform and represents the trap directly below the vestibule door. The bottom of this vestibule door determines the height of the platform. The doors are made to fit (Fig. 14) and two holes as shown in A are filed in each. The lower hole is covered on the inside with another sheet of metal (Fig. 5) to form the panel. Provide a means of holding the material in place as outlined for the other windows.

The opening at the rear end measures $1\frac{1}{16}'' \times 1\frac{1}{16}''$, it being located $\frac{3}{16}''$ above the lower edge.

File a rabbet in the roof at the rear of the car so that a small section of metal roof can be in-

stalled, this to allow the roof to overhang at this point. Solder in place.

Refer to Fig. 17 in the circle on page 90 for the method of making the front beam. Make two pieces to form the top and bottom, as shown, taking the measurements and radius from drawing H, and solder these together with a piece of $\frac{1}{16}''$ wide strip. Rivets as shown are formed in the edge of the assembly. This is then soldered flush with the bottom of the front end, and is located an equal distance from each side. The bell and bracket are made up as shown in Figs. 17 and 18. Solder to the beam as shown. The headlight turning (Fig. 19) is to scale and, incidentally, is too small for the installation of an ordinary bulb. The hole through this turning continues on through the front end of the car and at a later date a bulb and socket will be installed inside the car. The number brackets (Fig. 20) are made of $\frac{1}{64}'' \times \frac{3}{16}''$ stock and are soldered to the headlight turning. Also, the sketch of the face plate for the headlight (Fig. 21) shows how this piece should be shaped. Take the actual measurement from drawing H, and then solder it to the turning. Refer to F and G.

Fig. 15 shows the location of the grill work as seen on the prototype. The sketches (Fig. 22) will give an indication as to how this can be modeled. First, cut a piece of stock to the size shown in F and solder to it a number of short sections of round wire. These are filed off flush and a $\frac{1}{16}''$ strip wrapped around the outside for a frame. It is soldered in place. The screening below this is made in the same manner, it being substituted for the round wire rod.

The horns and bracket are made up as shown in Fig. 23. The horns are simple turnings.

Fig. 16 shows the two steps on the front of the car below the windows. These are bent up of the same flat stock as was used for the other construction, and soldered in place.

From elevation B on page 90 take the length of floor and fit it in place. As was mentioned before, this floor is held in place against supports made of brass flat stock $\frac{1}{16}'' \times \frac{3}{8}''$ and cut to fit between the car sides. See D. The two end supports are located as shown in B and the third one can be placed somewhere near the center of the car. These supports are located $\frac{3}{16}''$ up from the bottom edge of the sides and are soldered to them. Drill No. 42 holes through the wood and counter-sink for flathead machine screws. No. 50 holes to aline with these should be drilled in the supports and then tapped 2-56.

The one big distinguishing and satisfying feature of a self-propelled car is the roof assembly. The various radiation units, muffler, exhaust

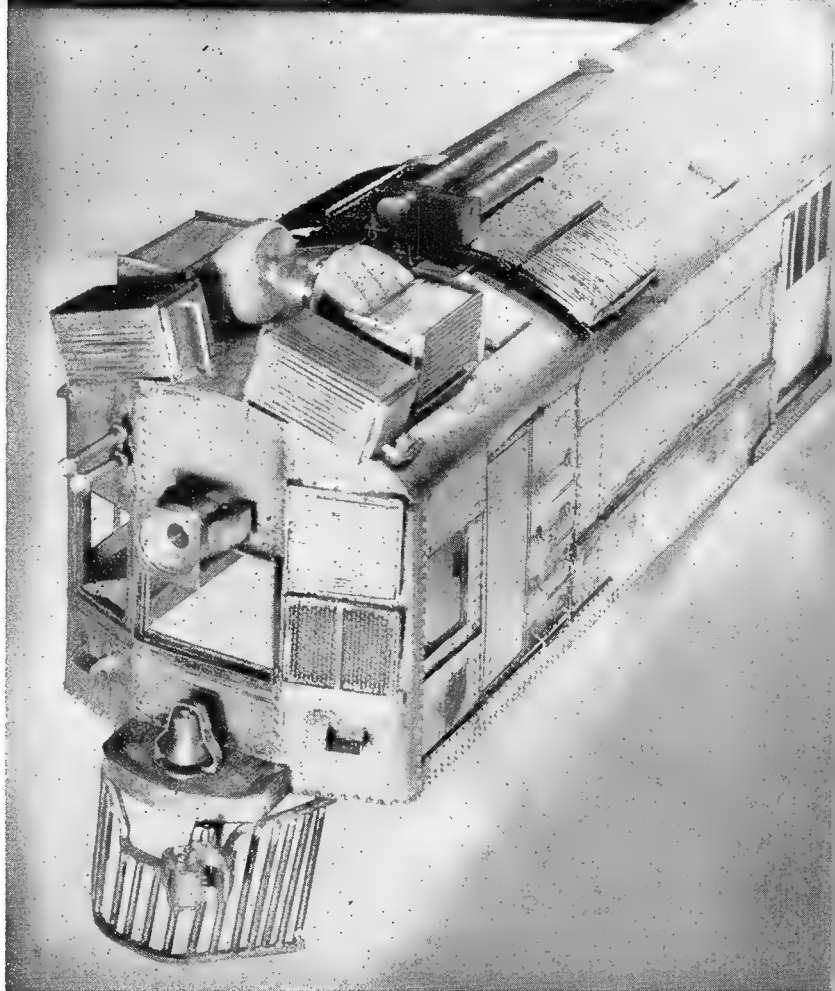
Model showing roof detail partially finished.

pipes, etc., intrigue the model maker. The units used on the roof of our gas-electric car are simple ones to model and yet look complicated and impressive. Care was taken in choosing the materials so that they would be easy to obtain. The only metal parts of an odd shape to be used are shown in Figs. 23 and 24 on page 96.

To begin with, cut four pine blocks to measure $\frac{3}{8}$ " x $\frac{3}{8}$ " x $\frac{3}{4}$ ". These are to be used in making up the radiators referred to on the full page drawing as Figs. 18 and 32. This last drawing also shows the various other parts that go to make up the complete radiator. Notice that two pieces, $\frac{1}{2}$ " square, are cut from sheet brass about .012" thick. These are nailed to the ends of the block of wood, using at least two nails to prevent the parts from spinning. The brass plate should protrude equally on all sides from the wood block and the nail heads should be filed flush. Next, cut two brass plates $\frac{3}{8}$ " square from brass stock $\frac{1}{32}$ " thick. These are centered on the brass plates and soldered together. The reason for the assembly being made in this manner is obvious. The various parts are formed into a solid unit without the nail heads showing.

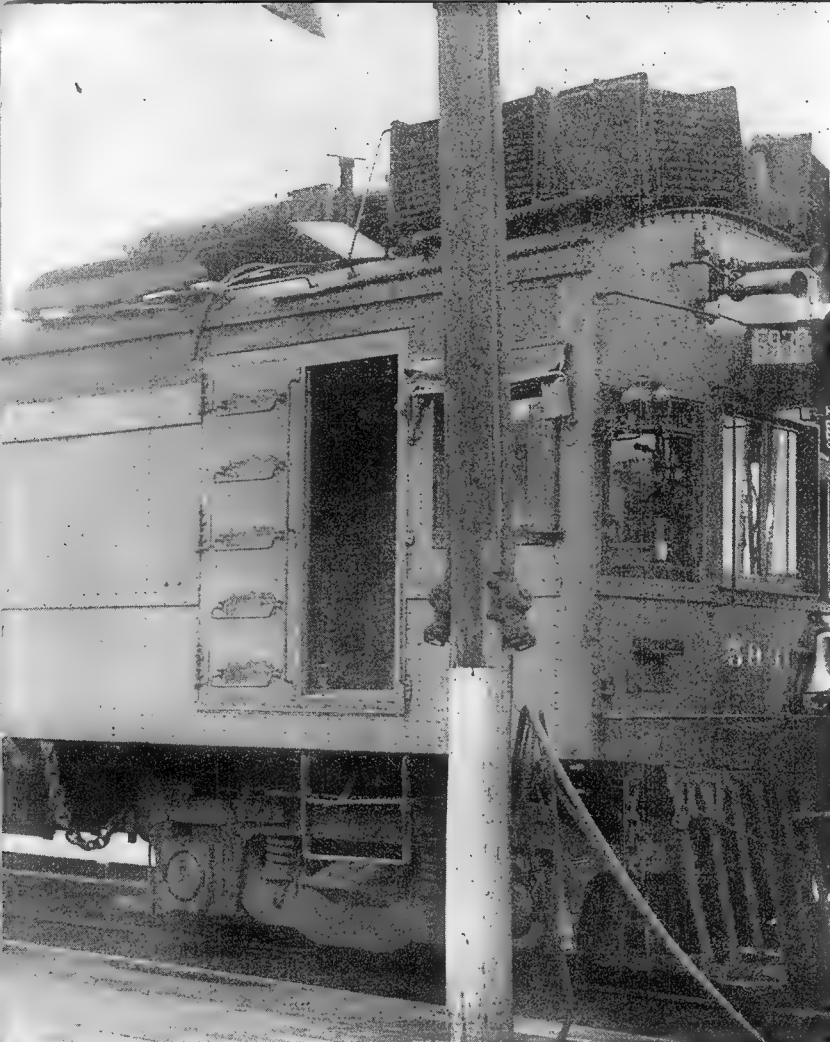
Cut a multitude of brass wire pieces to an equal length. These should just fit between the brass plates just described. Quite a number of them will be used and it would be well to prepare them all before soldering. All wires should be straight and true to allow them to nestle side by side as shown in the drawing. Solder them together and to the brass plates. Notice that the two radiators facing the front (Fig. 18) have wires placed over the front surface and the top surface, whereas the two radiating units directly behind and running lengthwise of the car have the wires placed only on the sides. The top is left clean.

On the two forward radiators drill a hole in the ends for the pipes shown in the elevation K. Taking advantage of the metal roof covering this section of the car, solder the two forward radiators in place, using the metal end plates as legs.



Before attaching the other two radiators in place refer to the plan of the fore section of the roof, in particular to Fig. 24, which is the turning that represents the fan motor. This turning, incidentally, is forced into a round spool at each side of it. The diameter of the spool can be determined by referring to elevation K. Notice that the top of the spool is fashioned to a flat surface on an angle as shown in section J and also on the roof plan, L. As a further help, glance at the photograph of the model on page 93.

These spools are drilled through the center to take the turning, Fig. 24, and are glued to the radiators at this time. Force the turning into the holes provided in the spools, spacing the assembly as shown in section J. Solder this radiator assembly to the metal roof. Observe that a piece of $\frac{1}{16}$ " wide strip stock is used as a supporting member between the radiator and the roof on the side nearest the roof edge. Holes should be provided in the rear ends of these radiators for the pipe connections. The pipes leading to these various radiators are simulated by using brass wire about $\frac{1}{32}$ " in diameter. Drill the necessary holes in the roof, bend the wires to the approximate shapes shown, and solder them in place.



Right front view of prototype, showing roof detail and pilot.

All excess solder should be cleaned off to keep a neat appearance.

The muffler box is made up by soldering pieces of brass together as shown in Fig. 27. Lay out and drill two $\frac{3}{16}$ " holes in the muffler box as shown to take the two mufflers referred to in Fig. 28. Cut two pieces of $\frac{3}{16}$ " brass tubing, $1\frac{1}{4}$ " long, and force these into the holes just mentioned. The wall thickness should be about $\frac{1}{32}$ ". The assembled mufflers and muffler boxes are soldered to the metal roof as shown in roof plan L. The positions of the mufflers are referred to as Fig. 31. Two roof hatches are fastened to the roof, Fig. 26, with either cement or solder. The hatches are $\frac{1}{32}$ " thick and $\frac{1}{2}$ " square.

A crankcase breather is made up next and the cone-shaped intake of this device can be modeled either by making a turning to the shape shown or by bending a small piece of tin to the form of a funnel, or by a last but not least satisfactory method, whittling the piece out of wood. At any rate, the part should be soldered or glued to a piece of bent wire as shown in Fig. 23 and the unit then soldered in place directly in front of the muffler.

The accompanying photos will help you to add many more details to the front end of the roof if you feel so inclined. To take the pictures of the roof details as shown on page 95, this humble person's neck was in a sort of "picadilious" position for a while. I stepped on a spot of grease while walking on the roof and . . . well, almost but not quite, if you get what I mean.

This car has two auxiliary wing radiators. These are used only during extremely hot weather. They are placed one on each side of the mufflers and are made up as shown in Fig. 29. To begin with, a piece of $\frac{1}{32}$ " thick brass stock is cut and bent as shown. A mate is made for the other side. A number of wires are then laid side by side and soldered to this piece. Again refer to the drawing. You might find it easier to solder the necessary wires to a piece of $\frac{1}{32}$ " flat stock and then do the necessary bending after the soldering is finished. This last suggestion has a few points in its favor and also a few against

it. If you do a good soldering job before bending no trouble will be experienced, and the method will save you the trouble of bending each wire separately to the contour of the $\frac{1}{32}$ " plate. Cut two end pieces to attach to the assembly, as shown, from thin brass stock. Notice that the bottom edge of this plate is formed to a point at the center to carry out the prototype design. This piece is soldered to the outside edge of the auxiliary radiator in each case. The method of attaching these radiators to the roof is somewhat up to the builder. A few brass pads can be soldered to the roof and to the assembly so as to position the radiators $\frac{3}{32}$ " above the roof surface. The main thing is to use a method that is not too obvious. With these radiators attached to the roof, a piece of $\frac{1}{32}$ " square brass wire is fitted over each as shown in the roof plan I. These two pieces are soldered directly to the auxiliary ventilators and run lengthwise with the car. Refer to the various photographs and the drawings. These are just a few more of the details that have no apparent use but do help make the model look better.

The roof ventilators are of wood and are filed to shape from pieces $\frac{1}{8}$ " thick, $\frac{1}{4}$ " wide and $\frac{5}{16}$ " long. The only filing necessary is to round off one of the surfaces as shown in Fig. 30. The positions of these ventilators vary somewhat with the different cars of the series. It is suggested that five ventilators be placed on each side of the car roof in the following positions: the first two as shown in the roof plan L; the third one (counting from the front of the car) on the right side and the fourth one on the left side with the spacing between these four equal; the fifth, eighth, and tenth ventilators on the right side, and the sixth, seventh, and ninth on the left side. Place ventilator No. 5 over the first window, ventilator No. 8 over the seventh window, and ventilator No. 10 over the eleventh window. The remaining ventilators, Nos. 6, 7, and 9, are placed over windows 3, 5, and 9, respectively. All are placed the same distance out from the center of the roof. A good glue to use is model airplane cement, as it dries rather quickly and is permanent.

The rear vestibule steps are a commercial product and it is suggested that you buy these rather than make them up, due to the fact that they are priced so cheaply. Being made from brass, they can be soldered directly to the metal vestibule floor. It is also suggested that a com-



Closeup view of mufflers, radiating units and pipe details.

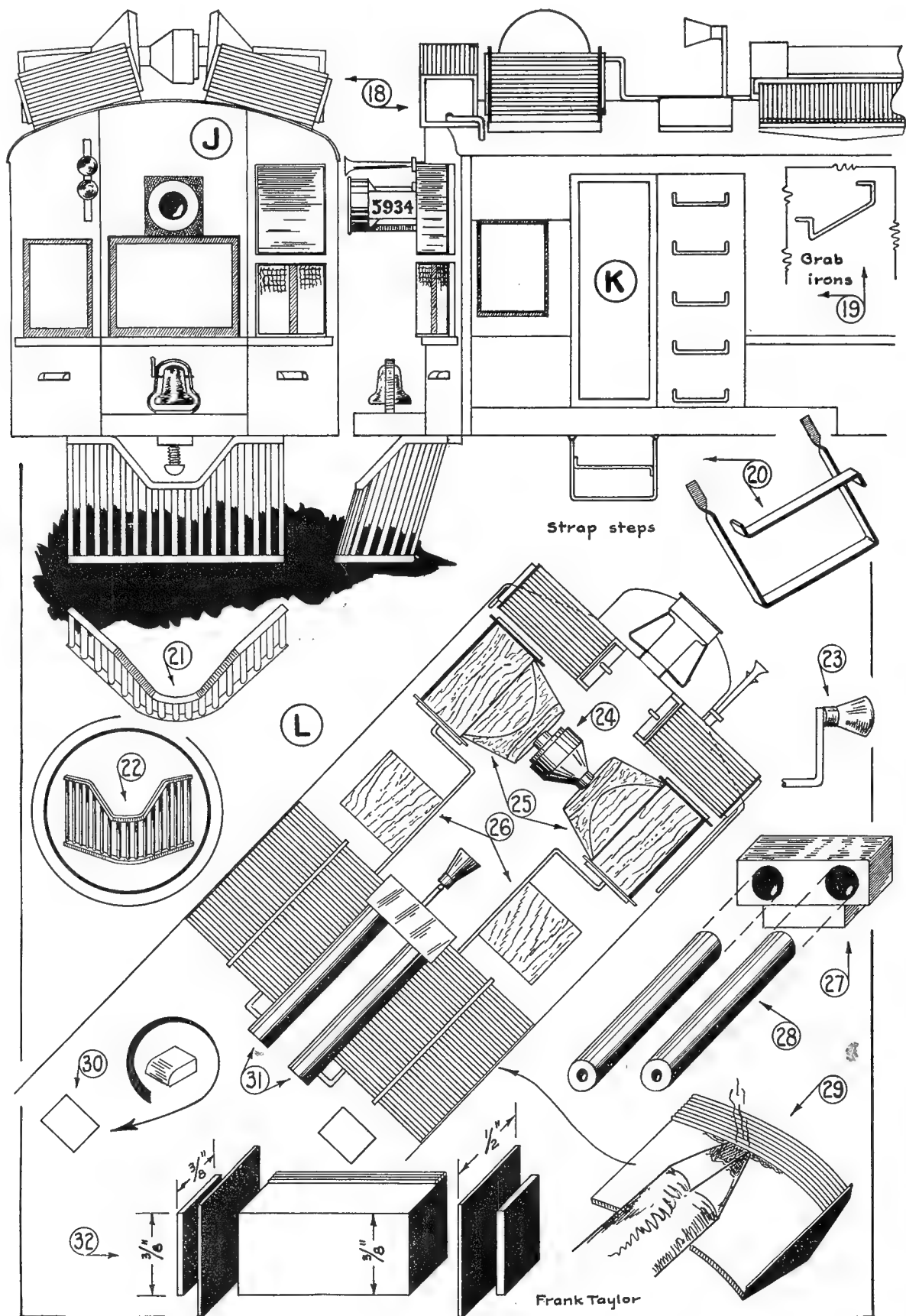
mercial diaphragm be procured. These are available in several forms, one of them being made with folded bellows from a strong grade of paper with a metal rubbing plate and the other a molded rubber diaphragm that is equally workable and very effective. Do not attach these diaphragms to the car until it is painted.

The pilot is a rather tricky thing to make and will develop a headache for you if the right procedure is not followed. To acquaint yourself with the facts, refer to the drawing on page 96, on which four views of the pilot are shown. Cross section J shows a full size view of it from the front. Elevation K shows it full size looking from the side, and Fig. 21 is a full size view looking directly down on it. The fourth view, Fig. 22,

shows the unit in perspective. Begin by cutting off two pieces of $\frac{1}{16}$ " square brass, each about 3" long. These will form the top and bottom members of the pilot. Bend the lower one in the form of a V, using Fig. 21 to help you achieve the correct shape. The upper member is a bit more complicated in that, in addition to the V formation, it must also be bent downward near the center. This is shown shaded in Fig. 21. With these two pieces prepared, cut 10 spokes from $\frac{1}{32}$ " diameter brass wire, roughly 1" long. These will be cut and filed to the exact length in the process of putting them on later. Two pieces of wood $\frac{3}{4}$ " thick are used as



General view of arrangement of roof details and ventilators.



spacers between the upper and lower members at their outside ends. These members can be thumbtacked to the filler blocks in correct position with each other. It is then a simple matter to solder the spokes in position. Start with the center one and work outward, fitting each piece as you progress. Do not remove the spacer blocks until the increased spoke installation forces you to. Solder the completed pilot to the car in the position shown. Solder a $\frac{1}{16}$ " thick piece of brass to the car bottom as shown in photo and drawing. Then drill and tap 2-56 for the coupler mounting screw.

The strap steps used beneath the engineroom and baggageroom doors are made from $\frac{3}{4}$ " x $\frac{1}{16}$ " brass strip. This material was also used in making the window openings. The engineroom step is shown full size in elevation K and the one used beneath the baggage door is pictured on page 88. These steps are made up as shown in Fig. 20, the only variation being that the baggage steps are only $\frac{3}{8}$ " wide. A half twist is made in the material to facilitate the step mounting. Place the twisted sections against the inside surface of the car side and solder in place. After this the middle rung is bent to fit and soldered.

The grab irons and hand rails are installed as on a standard passenger car. Install one on each side of the rear doors and one on each of the engineroom doors. Refer to photos. Five grab irons are put on the engineroom doors, as shown. Lay out the position of each grab iron and drill the necessary holes. Grab irons can be bent up uniformly by cutting a block of wood to the right width and then using it as a former, bending each wire around it to make grab irons of the correct width.

Order either a No. 1 or No. 2 K. & D. motor from your hobby shop or manufacturer. An R-8 rectifier should also be ordered. A nearby radio store or Hobby Industries, Box 832, Milwaukee, can supply it. A pair of four-wheel passenger trucks insulated for two-rail are to be purchased. After looking through the various catalogs it was found that Lobaugh's Pennsy four-wheel trucks would be ideal.

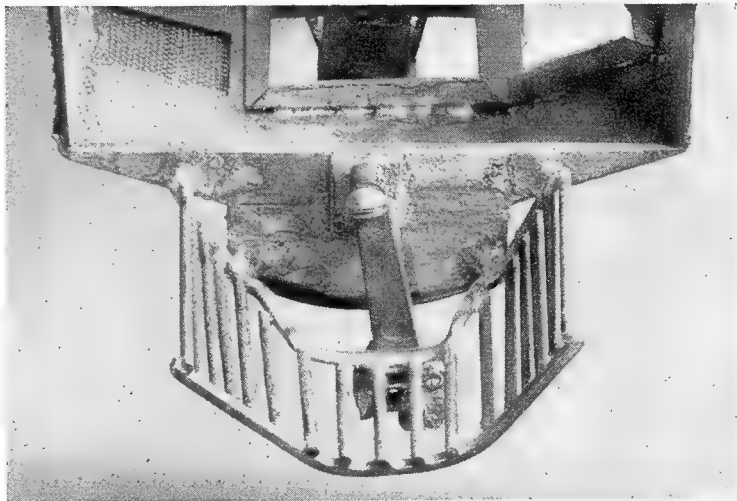
The set of gears used in this power unit has been made especially for the job and can be purchased through Hobby Industries, Box 832, Milwaukee, Wis.; Rollin M. Lobaugh, 1179 Howard St., San Francisco,

Calif., or Lange's Model Supplies, 20 E. Jackson Blvd., Chicago, Ill.

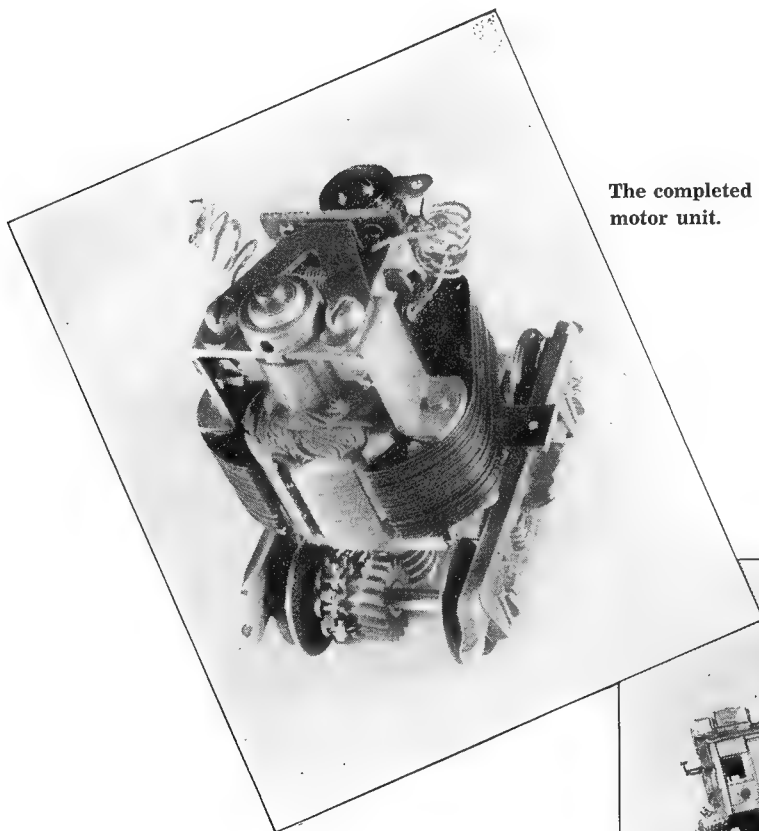
A trial run proved this unit to be both quiet and powerful. In fact, a No. 1 K. & D. motor could be used instead of the No. 2 without experiencing harmful results. The compactness and design of this motor unit will allow it to be used in other equipment in case you do not care to build the gas-electric car described in this series.

Page through this chapter and look at the various photos and drawings. The drawing on page 100 in particular will impress you with the simplicity of the unit. An outstanding feature is the adjustable axle bearing which allows the chain tension to be adjusted for efficiency and wear. This bearing can be split as shown at E, a possibility that you will appreciate as time goes on.

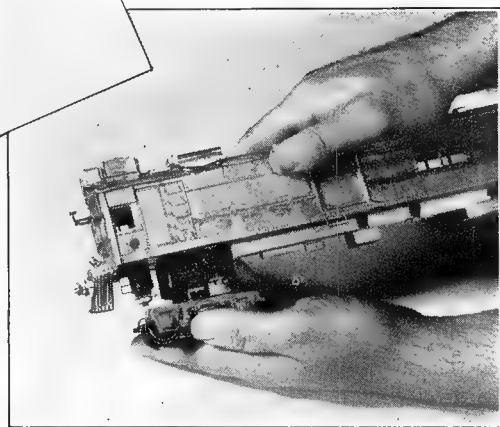
Well, this car will never run if all we do is talk about it, so let's get started. One of the trucks you purchased should be dismantled and one wheel pressed off each axle. An empty cigar box should be on hand to hold the various parts to insure their safe keeping. The pressed metal bolster used on this truck can be discarded and a new one made as shown on page 100 at A. Transfer the outline of this bolster template from the full size drawing to a $\frac{1}{32}$ " thick sheet of brass stock. Cold-rolled steel can be used if you prefer. Scribe these lines accurately and then locate and scribe the lines shown dotted in the drawing. The bolster will be bent to shape eventually on these last named lines. Next lay out and drill the various holes as shown. To insure accuracy, the largest hole should be laid out with a pair of dividers before the hole is drilled. This particular hole should be opened up with a series of drills, each one somewhat larger than the last, and if toward the end you notice that the drills



Method of mounting front coupler and pilot assembly.



The completed motor unit.



Unit fits into motor compartment of car.

are not cutting in conformity with the line scribed previously with the dividers, then file out the remainder to the scribed lines. This hole must be located accurately in order that the motor will line up. If the hole were smaller and the stock thicker this drill walking problem would not be encountered, so the above suggestion is the proper antidote. The elongated hole also located on the center line is shaped by drilling two holes side by side and then filing away the excess material between.

Bend the bolster down on each side and up at the front. The bend at the front is for additional strength and upward so as not to interfere with the chain. It is bent down on each side so that the holes can be used to fasten the bolster to the truck side frames, using the same tapped hole as was used to fasten the original bolster in place. After the bolster is bent to fit between the side frames its over all width should be the same as that of the original bolster. This will give proper clearance between the wheels and the truck side frames.

Refer to *F*, which shows the bolster assembly, top view. This shows the bolster at the present stage of the game and also the king pin turning that is riveted to the bolster from the bottom.

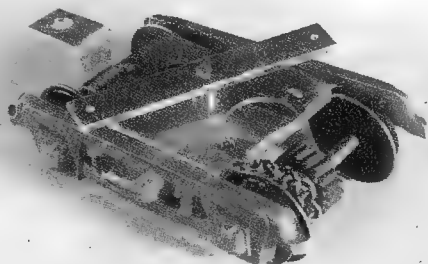
This particular hole in the bolster can be countersunk on the bottom side to form a strong joint. After the riveting operation, file off the head flush with the surface of the bolster. Next make the body bolster as shown in the same drawing from $\frac{1}{16}$ " x $\frac{3}{8}$ " stock cut to the width of the car. Drill a hole in the center just sloppy enough to allow it to swing freely on the turning just mentioned. Hold the bolster in place by riveting over the turnings as shown in *C*. Drill two No. 42 holes $\frac{1}{8}$ " in from each end of the body bolster. These will be used eventually in fastening the truck to the car body. If you intend to run this unit on D. C., a rectifier support should be bent up as shown in *C* and *F* and soldered to the bolster for mounting the rectifier.

Two spacing collars are used on the axle having the adjustable split bearing, and along with these, the sprocket gear. The spacing collars are made as long as those shown in the full size drawing and are positioned against each wheel,

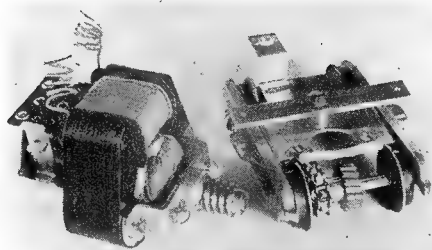
the sprocket gear and bearing assembly being made to fit between them. The sprocket gears are turned to the size shown and are pinned to the axles by drilling through the hub of each gear and axle with a No. 51 drill and then using a $\frac{1}{16}$ " brass rod for the pin. This pin is riveted over on each end to secure the assembly.

The adjustable axle bearing is made from $\frac{1}{8}$ " thick brass stock. If the material is slightly thicker as shown in drawing *D* it will not matter. The first step in making this axle bearing is to cut two pieces of stock as shown in photo No. 2. Notice that the two pieces are held together with the two machine screws. Drill No. 50 holes and tap 2-56 in the long piece; the corresponding holes in the square piece of metal that forms the other half of the bearing are drilled to No. 42, the clearance holes for the machine screws. Assemble the two pieces and draw them together tightly with the machine screws and then drill the other two holes No. 52, for the lead pins. Force two $\frac{1}{16}$ " round pins in place as shown in drawing *E* and enlarge the two receiving holes with a No. 50 drill. This will give a nice slide fit and cause the two halves of the bearing to line up accurately each time. This would not be the case if we depended on the machine screws entirely for this purpose. Locate the position of the axle hole with a punch and drill through the assembly for the axle as shown in photo No. 1. Remove any burrs that were caused by drilling. Next, determine just where the shank of the bearing should be bent and bend the piece to the angle shown. Hold the single end in the vise and hit the protruding part with a lead hammer to prevent injury to the

Body, bolster and rectifier mounting angle in place.



Motor ready for assembly.



machined parts. A block of wood can be used with an ordinary hammer as an alternative.

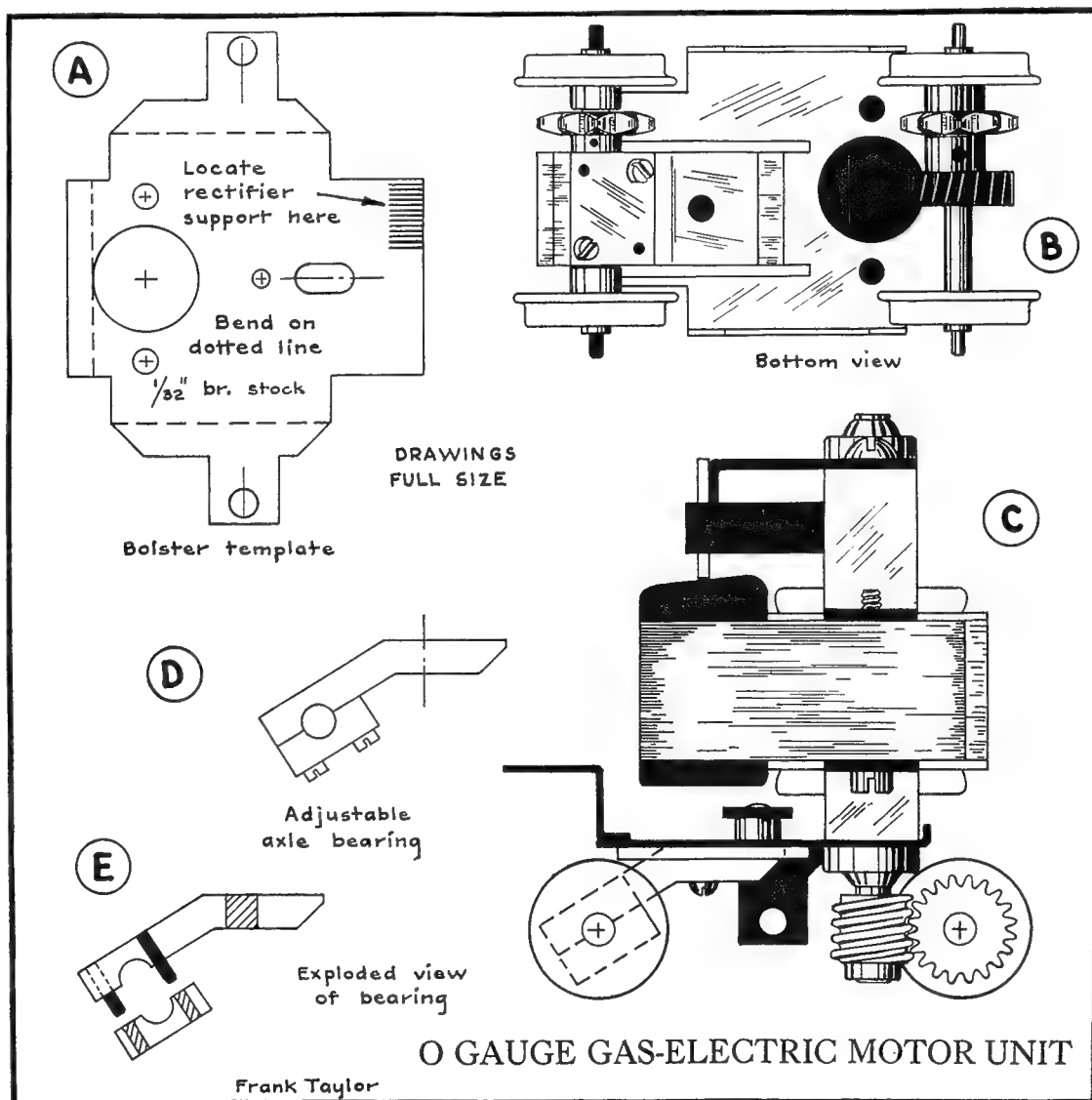
Cut the shank of the assembly off and shape as shown with a file. Indent the location of the hole for the mounting screw, shown in both *D* and *E*. Drill the hole No. 36 and tap 6-32.

The hole provided in this bearing, the spacing collars and the sprocket gears are determined by the size of the axle you are using. The various manufacturers use different size axles and in some cases it will be necessary for you to bush the hole in the sprocket gears or the bakelite gears.

All of the parts that slip on or fasten to the axle have been described. The assembly should be made as shown in the drawings and photos. Fasten the adjustable axle bearing to the truck bolster in a position so that the wheel spacing is as shown at *C*. Next, run the chain around the sprocket gears, cut off the excess linkage and fasten the chain into a loop

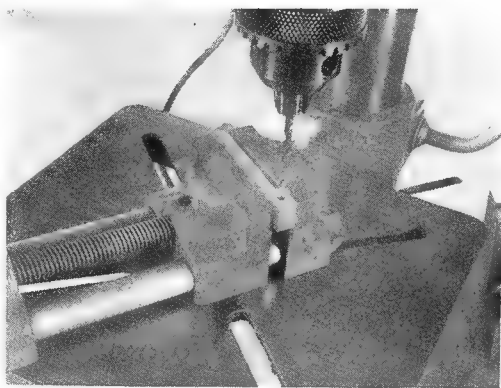
as shown in photo No. 3. Before putting the chain in place, solder two retaining strips of $\frac{1}{16}$ " square brass firmly to the truck bolsters, one on each side of the adjustable axle bearing. Without these two retaining strips the axle would be able to swing from side to side. The protruding sections of the axle going through the split bearing have to be filed off flush with the outside of the wheel. The part to be filed off is drawn solid black in *B*. Naturally, if this adjustable axle is to function, all parts of it that might come in contact with the truck side frames must be filed off. Assemble the unit as shown in photo No. 4. You might find it advisable to elongate the holes used in fastening the bolsters to the truck side frames, as shown in *F*, in order to bring the top of the truck bolster even with the top of the side frames.

Slip the worm gear on the motor shaft and pin it in place, and then file off whatever stock is

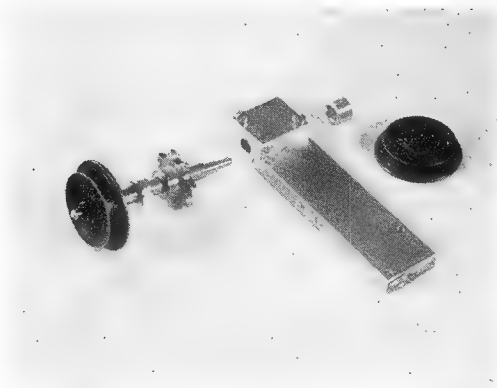


necessary to make the assembly conform to drawing C. Mount the motor to the truck bolster plate and attach the rectifier in position.

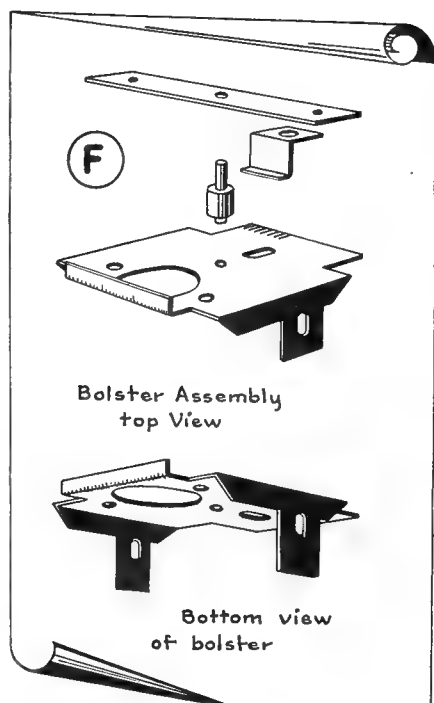
Of course, if your road is powered by A. C. and you are going to use hand reverse or some type of sequence or controlled remote control, forget



1. Split axle bearing held in vise while drilling. Notice screws holding bearings together.



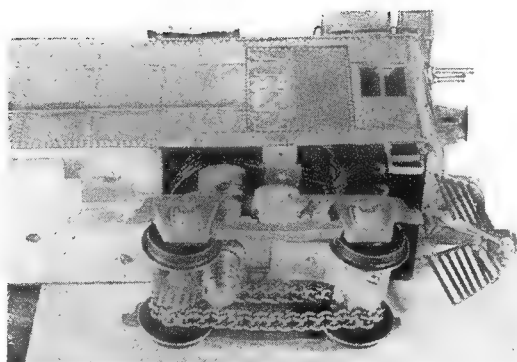
2. One wheel forced off axle to allow assembly of spacing collars, sprocket and bearing.



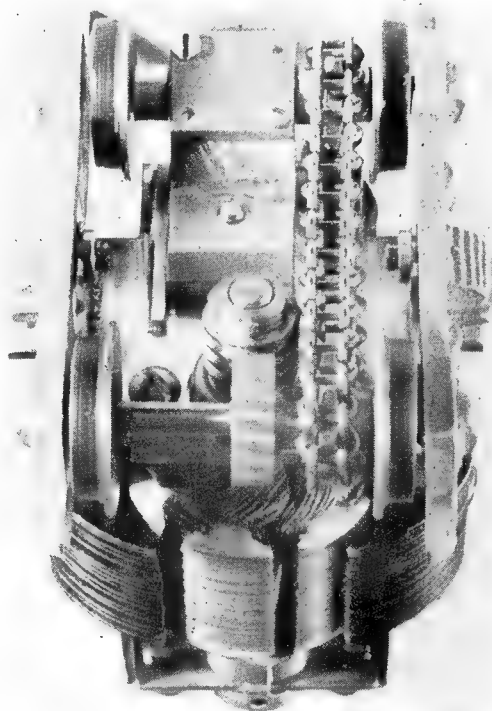
about the rectifier and mount the hand reverse under the floor with the lever at the side where it can be reached easily, or put the remote control relays in the baggage compartment. The rectifier system with D. C. power is so popular now that we made up our demonstration model with this in mind. Refer to the drawing on page 102. This shows the proper electrical hookup so that the same car, rectifier and all, can be used with either A. C. or D. C.

Next solder two angles to the side of the car as shown in the top photograph on this page and drill two No. 50 holes in them to match with those drilled in the truck body bolster. Tap the holes 2-56 and mount the trucks.

If you wish, a standard light bulb socket can



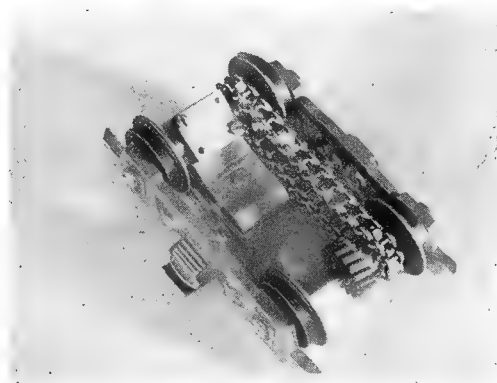
The truck body bolster alined with the body angle plate and ready for the fastening screws.



Bottom view of completed motor unit.



3. Axle assembly, sprocket chain, truck bolster and side frames ready for the screwdriver.

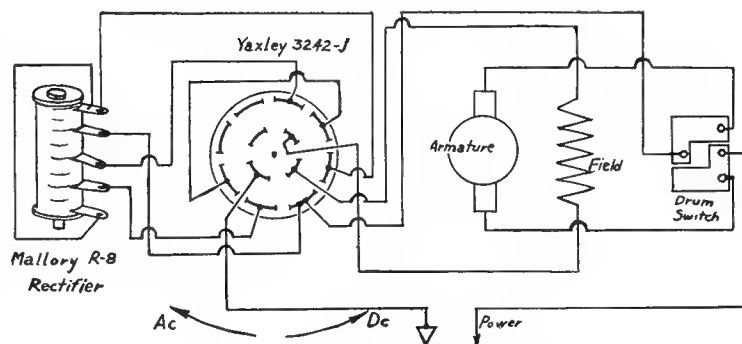


4. Bottom view of assembly. Notice the screws and guide pin holes in rear axle bearing.

be installed inside the cab out of the way of the motor to allow the light of the bulb to shine through the dummy headlight.

Paint the car whatever color your taste dictates and then install the window material, after which the retaining tabs are bent up in holding position. The rear truck is mounted to just clear the rear steps.

The model illustrated was insulated for two-rail. The wheels on the right side of one truck are insulated, and those on the left side of the other truck are likewise insulated. Thus one truck is grounded to the left rail, and the power leads are accordingly connected one to each



Wiring diagram for A. C.-D. C. reversal.

truck. If third rail is used the shoes should be fastened at the inside end of each truck, building brackets out from the bolsters to hold them firmly in place.

A LOADING CRANE

Photos show the prototype.

Build This Husky Timber Crane to Handle Heavy Loadings on Your Model Railroad.

THE crane pictured on this page is used quite extensively by the Chicago & North Western at Milwaukee, and a crowd never fails to gather when it is put to work. Loads of great variety are moved, and the crane, which was built of 18" timbers, can handle up to 30 tons.

To make a model of this crane, a few inexpensive and easy-to-obtain materials are required. A pine board ripped $\frac{3}{8}$ " square, 6 mm. or 5 mm. square for O, OO or HO gauge models respectively, and a sheet or two of $\frac{1}{16}$ " thick balsa, along with a piece of tinfoil about as thick as a tomato can, will just about take care of the requirements.

The structure is mounted on a piece of $\frac{1}{4}$ " 3-ply veneer, and the location of the various parts can be laid out on this board. A side and



top view drawn to $\frac{1}{16}$ " scale is shown on page 106. To obtain the size for pieces *a*, *b*, *c*, etc., measure the drawing. Each $\frac{1}{16}$ " represents 12" on the prototype. On knowing the full size dimensions, you can lay the parts off to any of the various scales by using a conversion rule, which can be obtained from any of the manufacturers. For example, in Fig. 11 timber *b* measures $\frac{25}{16}$ " long, which means 25 ft., and converted to O gauge is $6\frac{1}{4}$ "; OO gauge, 100 mm.; and HO, $87\frac{1}{2}$ mm.

Fasten the timber joints together as shown in Figs. 8, 9, and 10. The plates shown are made of tinfoil and are fastened in place with bank pins. In addition, the joints should be glued and pinned together for added strength. The templates on pages 104 and 105 are for the three popular gauges. Transfer these shapes to a piece of sheet metal, and cut and file them to shape.

The turntable shown on page 104 is also made of tinfoil. On the prototype the rim was bent to shape from a length of 6" angle, and in the model two pieces of metal are used to form the rim after



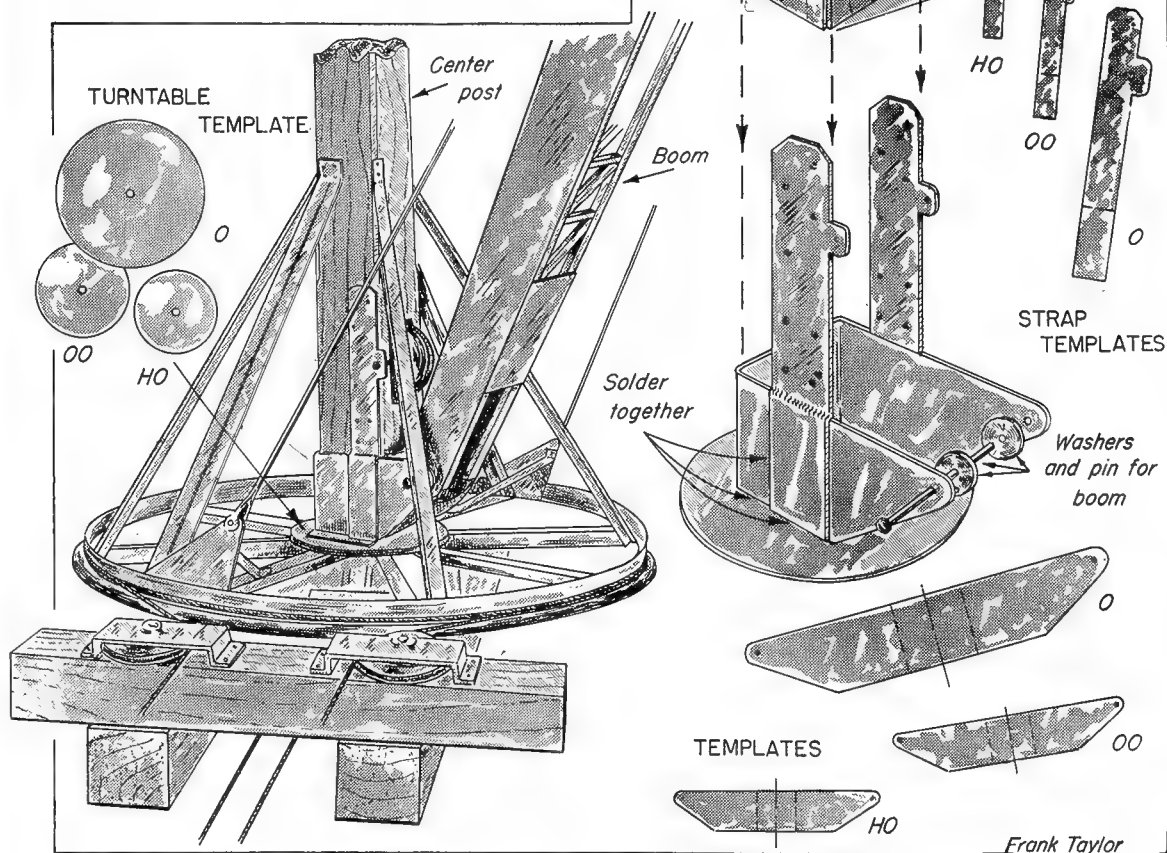
they are bent to the shape shown. The parts are soldered together and filed clean. The spokes and upright braces to the center post are also angles of the same size, but due to the fact that these are not bent out of true, they can be shaped in the vise from one piece of metal.

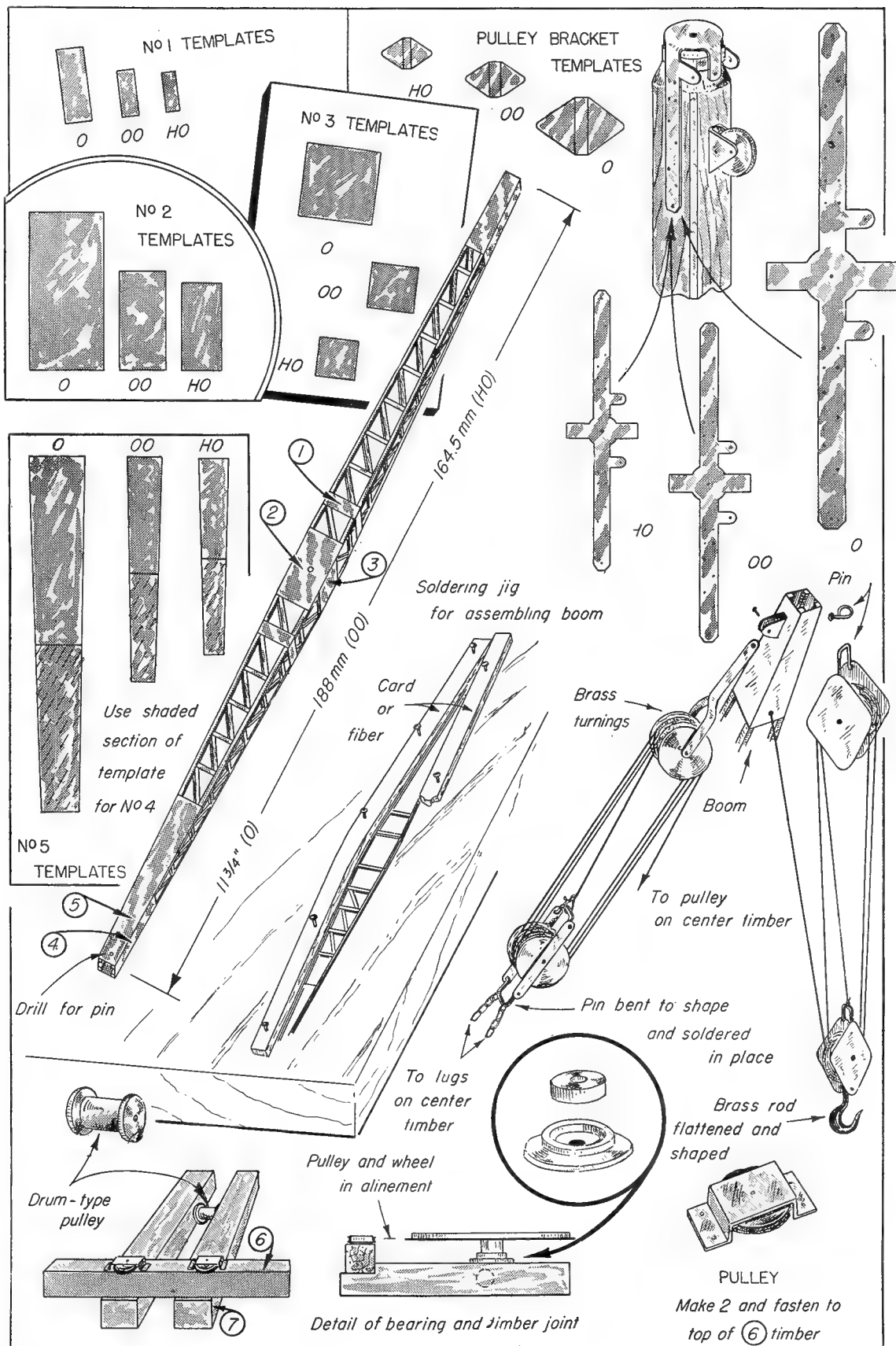
The assembly of the structure can be best understood by studying the various drawings. Notch a cavity in the center beam for the pulley. After this cavity is made, drill a hole through the center of the beam so that a cable can later be run around a drum type pulley between timbers (Fig. 7), then up through this hole in the beam and around the pulley in the cavity, and then on up to the pulley which is shown fastened to the upper section of the center beam on page 105.

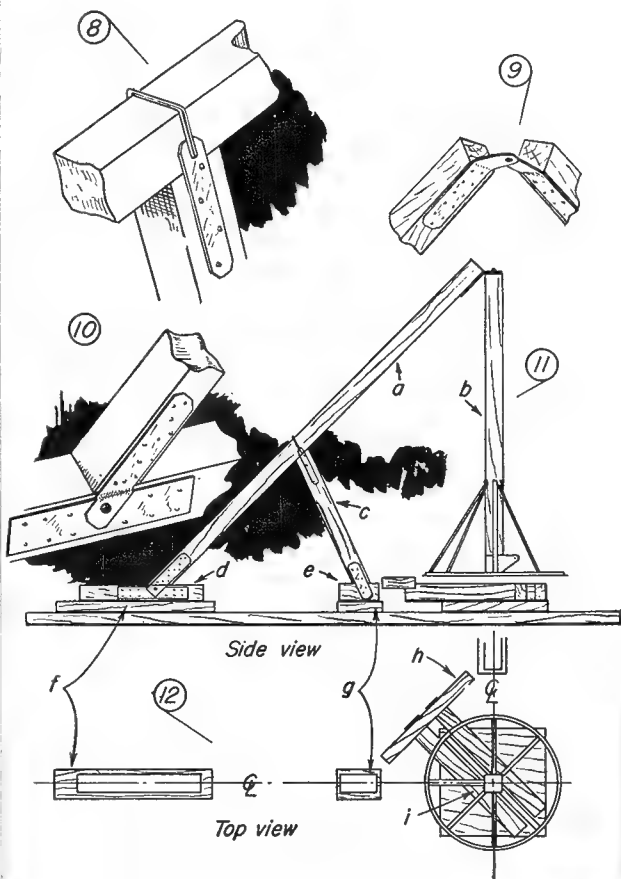
The boom is made of $\frac{1}{16}$ " square brass wire for O gauge, $\frac{1}{32}$ " stock for OO or HO gauge. This material, incidentally, is carried by some manufacturers for third-rail purposes. The form of the boom is obtained by making the various pieces needed to the shape of the No. 1, 2, 3, 4, and 5 templates. These are placed in position, preferably in a soldering jig, as suggested in the drawing, and then soldered to the long square stock just mentioned. Make two sides first, in-

and then join the sides together, as shown in the drawings and photos. File off all excess solder, drill the pivot holes at the base of the boom, and try the unit in the turntable socket for a fit. Use a washer on each side of the pin between the boom and each bearing plate, and solder the pin in place.

The pulley turnings can be made on a lathe







or drill press, or can be purchased from a ship model supply house or hobby store. Each of the four pulleys used is slightly different from the others, either in shape or in the number of wheels or sheaves. The method of stringing the cables is shown, and the number of sheaves contained in each block can be determined by counting the number of cables passing through it. The cable used in the model is a good grade of fishermen's line.

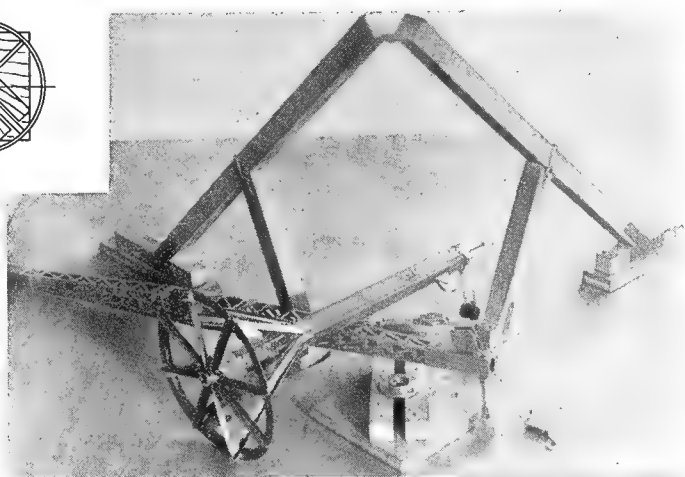
At the bottom of page 105 is a detail drawing of the bearing used beneath the turntable. The lower half of the bearing is drilled for two pins which hold the plate to the No. 7 timber. This type of bearing is used to allow the cable to pass through the center of it.

Railroad equipment such as this loading crane is usually designed to fit the needs of a particular locality, and for this reason almost every crane in existence is of a different design. Detailed explanations concerning the construction of this particular crane have been waived, thus leaving the minute details up to the mood of the builder. The control shed is 14 x 20 ft., and about 12 ft. high on the side facing the crane. The rear wall

is about 10 ft. high, and has no opening in it. The pictures on this page show the finished shed, which was made of $\frac{1}{16}$ " thick balsa. The roof, door and trim were cut from cardboard and glued in place after the sides were scribed. Reinforcing posts $\frac{1}{8}$ " square were glued to the inside of the corners for added strength.

The crane can be operated, to all intents and purposes, from the control shed by installing a drum in the center of the shed. Over this the control cables pass. Holes are drilled in the table top, and the cables pass through these, then over another drum, and the end of the cables are then connected to suitable control hooks located at the edge of the table within easy reach of the operator. Notice that the cable which controls the circular direction passes twice around the rim of the turntable before entering the control shed.

Paint the metalwork black and stain all woodwork gray before installing the cable and ballast material.



The upper photo shows the various parts ready for assembly and the paint shop. The completed crane and control shed are shown below.

MODEL CULVERTS

How to Build Plate Girder Type and Suggestions on Other Styles.



CULVERTS do not play any part in the running of a model railroad but certainly do add to the pictorial effect of it. Notice that the one pictured above offers a good setting for pictures of the favorite model. Rolling stock is built to scale because it looks so realistic; it acts as a dream pill to the imagination and it should be a natural desire to complete this realism by adding the scenery and other appurtenances. Perhaps this phase of modeling the railroads has been rather slighted due to the lack of information available on the subject. In any event, let's try our hand at building a plate girder type culvert.

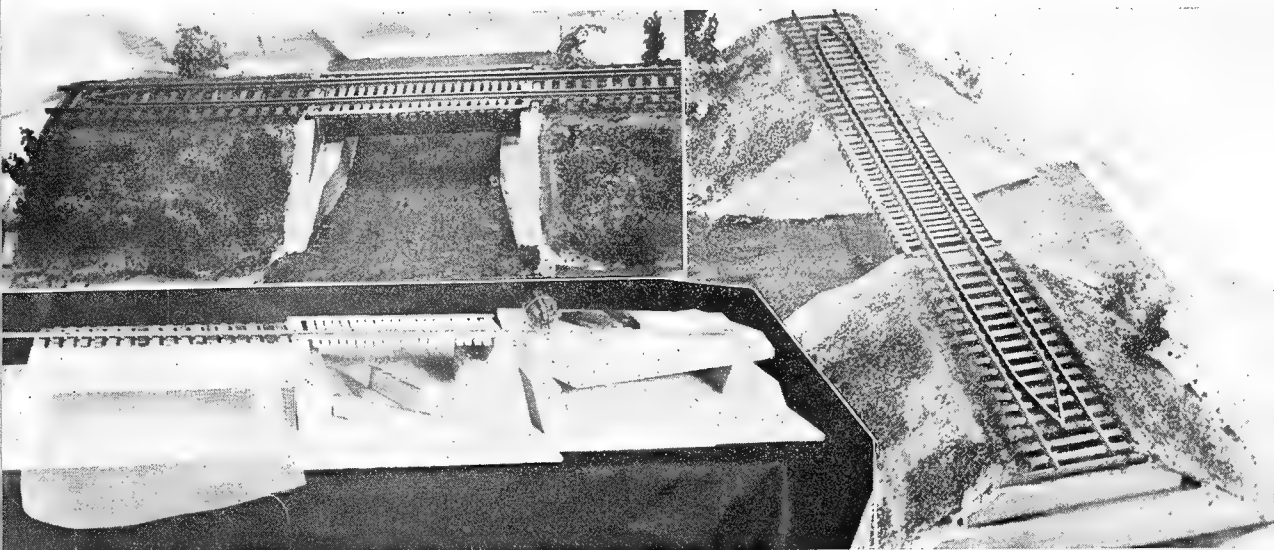
The materials necessary for this project are commonly used for other purposes. For example, the girder material can be obtained by cutting out one side of a 5-gallon oil can. This metal is about .012" thick and solders easily. Brass or tin coated iron sheet stock will also do the trick. In a pinch, the ends from an apple box could be used in fashioning the abutments, which, incidentally, also act as supports for the girders. Screening is used in modeling the embankments and can be obtained from a neighbor who is repairing his screen windows for Summer use. The fact that the screening is somewhat the worse for wear does not prevent its being used for our purposes, as the plaster of paris coating will hide a multitude of sins. Burlap or other cheap materials can be used if screening is not available. The ties used on the girders are of a special size and, if a powered circle saw is not available to cut them out of soft pine, they can be cut by hand out of balsa wood. This material can be obtained from

any of the model airplane supply companies. The fish plates can be used, or not, as your tastes dictate.

The two I beams are made of the same thickness material for all the small gauges (O, OO and HO). Refer to the drawing, which is scaled $\frac{1}{8}$ " to the foot, and determine the size of the girders for your model. Each $\frac{1}{8}$ " measured off the drawing will represent $\frac{1}{4}$ " for O gauge, 4 mm. for OO and 3.5 mm. for HO, other sizes in proportion. Three pieces of metal are used to form the beams, as shown, and are soldered together in a simple jig to insure the proper relation of parts. Clean off all excess solder.

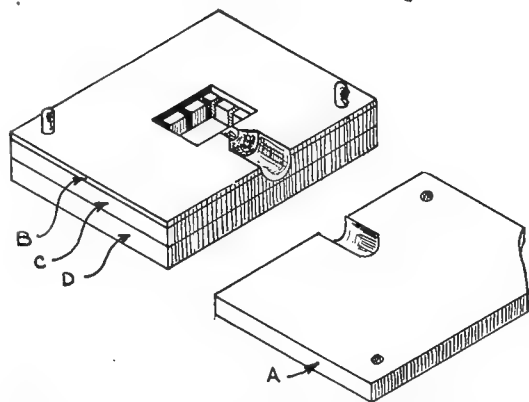
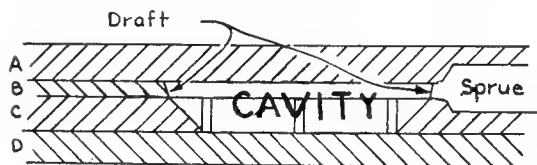
The two retaining walls are made from pine or other soft wood for ease in shaping. Lay out the parts, cut roughly to size with a hand saw and then plane or file to the finish lines. Boards or 3-ply veneer can be sandwiched together to form the retaining walls so that provision is made for the girder and tie supports without having to rabbet this section. See the sketch. Notice that the walls are thicker at the base. This chamfer or bevel is obtained on the lower half of the wall facing the drainage. Use a file, plane or coarse sandpaper and then finish off with fine sandpaper. Break all of the edges to conform with the real practice. For those who have power saws, the various set-ups necessary will prove interesting.

A piece of plywood is cut and used as a base on which the various parts are mounted. The size is not important but should be made convenient to slip in place on your layout. Scribe a center line



on it and then plot the locations of the various parts that are to be fastened to it. Set the retaining walls in place and nail the baseboard to them. Several small finishing nails can be pigeon toed through the walls and into the baseboard for additional strength.

Four pedestals are made next and serve two purposes. They support the I beams and help to prevent damage to the structure caused by the expansion and contraction of the beams. The four pedestals are identical and for this reason are tedious to make. All tasks that are repetitious are tiresome and for this reason a method of casting these parts is outlined. Making the die and casting these parts actually took less time



Section of the laminated die made for casting the bridge pedestals, and sketch showing the detail of the various layers.

The plate girder culvert shown under construction and completed ready for insertion in the layout. Arrangement of the various parts is indicated.

than if the "build up" method had been relied upon. This project will give you a peep into the die casting business and, perhaps, a few of the headaches that go with it. For those who want the easiest way out, the various parts can be made from balsa wood and glued together. Wood is not a good medium to use for the purpose but it will do.

The die is laminated, several thicknesses of metal being used to make the cavity easy to develop. Plates A, C and D are of the same thickness. As plate C determines the size of part of the casting, a checkup should be made to ascertain what this will be for your model. Some lenience is expressed so that easily obtained thicknesses in metal are usable. For example, plate C figures to $\frac{1}{8}$ " thick and plate B is $\frac{1}{32}$ " for the O gauge model, plates A and D being the same as C for convenience only. These thicknesses are obtainable in brass but would not be if reduced to OO or HO size so it is recommended that either $\frac{1}{16}$ " or $\frac{3}{32}$ " thick brass stock be used for plates A, C and D for the smaller gauges. Using $\frac{1}{32}$ " plate for B will allow the castings to be filed off slightly on the bottom for a more pleasing appearance. After all, the thicknesses of these castings vary in actual practice with different structures, so you can defy your friends to criticize them on the model.

Lay out a square to the size of the base plate on B. Drill several holes to remove most of the metal and then file the hole to the scribed lines. File a slight bevel or draft to the four edges to allow the casting to be removed. This draft must be filed on all surfaces that might cause the cast-

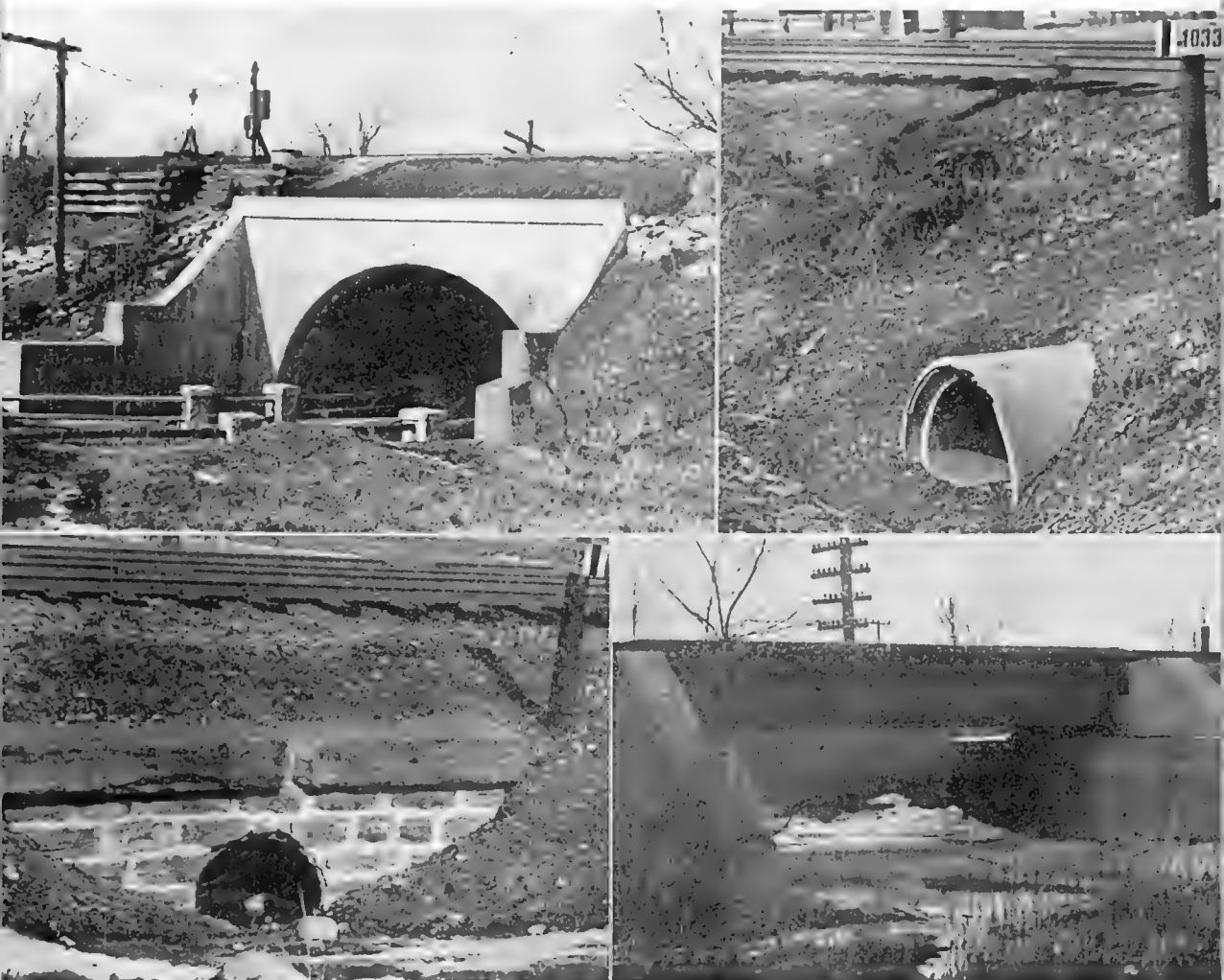
ing to stick in the die. Next, clamp plates A, B, C and D together and drill two No. 31 holes at opposite corners, as shown, to provide for the $\frac{1}{8}$ " lead pins. The holes in all of the plates except D will need to be redrilled No. 30 for a slip fit on the pins. Force the two pins in the No. 31 holes provided in plate D. These pins are equal in length to the combined thickness of the plates and should be rounded off slightly at the ends for easy entry into the holes. Assemble the plates and file an identifying notch across one of the edges to help you reassemble the pieces easily.

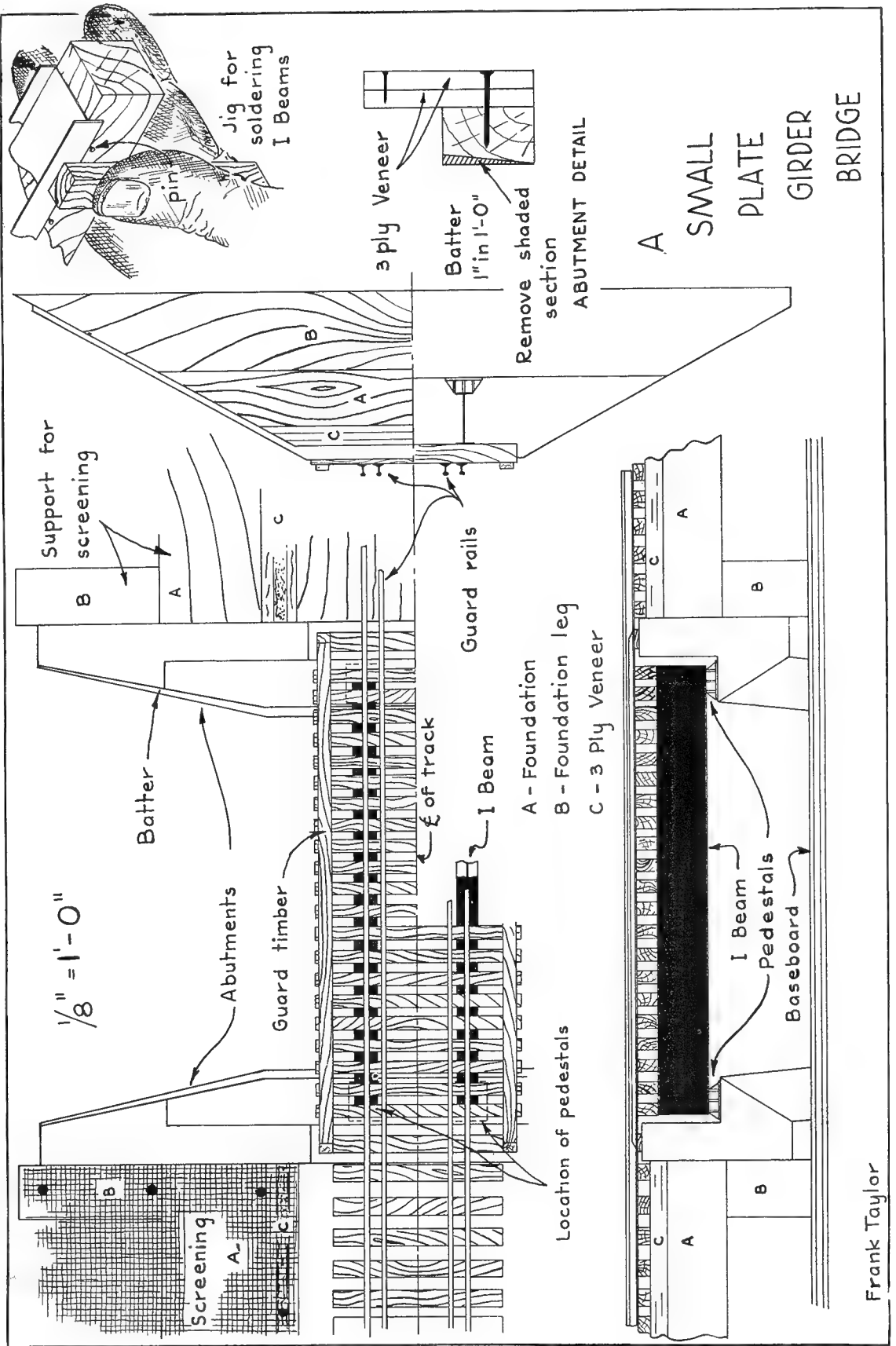
To continue with the cavity, clamp plates B and C together in proper order, alining by slipping $\frac{1}{8}$ " pins through the holes, then scribe lines on C, using the square hole in B as a guide. Unclamp the plates and use the scribed lines on C to advantage in laying out the rest of the cavity on

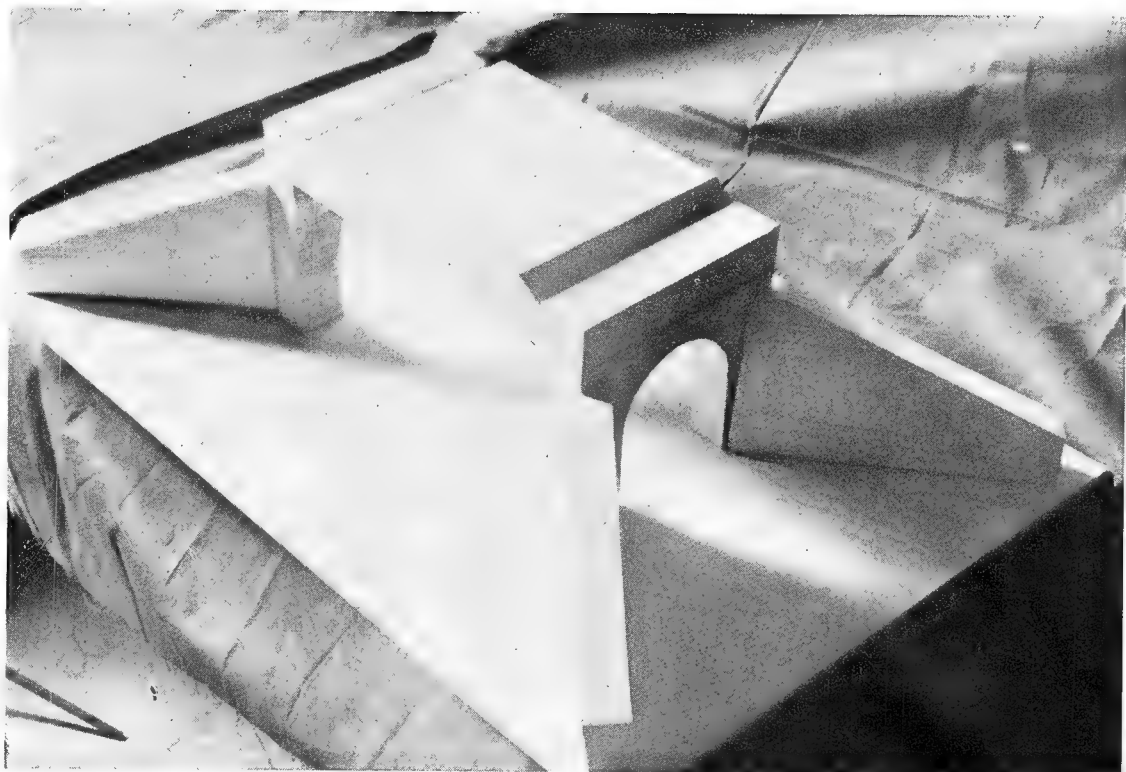
Here are various styles of culverts photographed along a sample stretch of railroad right of way. The pipe types of construction are modeled by easy and obvious methods.

this plate. Study the drawing and notice that the cavity in this plate will form the upper half of the casting, which includes the reinforcing fins and the square center section. The fins do not extend beyond the lines transcribed from plate B. Having noted these points, drill and file out the square center section, using methods adopted in making the hole in plate B. A set of small (4") swiss pattern files is very useful in building models and making dies. These are made by the Nicholson File Co., Providence, R. I., and are packed one dozen to a box, assorted. The file that cuts on the edges only is ideal for filing the slots. The file can be ground thinner if a narrower slot is desired. Tests, to check the development of the cavity, can be made by pressing warm candle wax in the opening.

The die is complete except for the sprue, which is a hole used in pouring the hot metal into the cavity. Assemble and clamp the die together preparatory to drilling the hole, and provide a means of controlling the depth of it. The hole







Model culvert of the concrete arch type under construction. Wood is cut to size for the prototype and assembled as shown. Almost any size and proportions which look right will do, as these culverts are made for many different heights of embankment and sizes of watercourse.

should be drilled deep enough to just pierce the cavity and then flared or filed out at this point to allow the metal to flow into the cavity easily. Heat the mold before pouring the castings, otherwise the metal will cool off before it has had a chance to fill the cavity. A pair of automobile pliers can be used to hold the die together when pouring the pedestals. Lead was used rather than a lead-tin alloy.

The I beams and pedestals are now ready for installation. To locate these properly they should be placed directly below the running rails. Drill a hole through the center of each pedestal casting and nail it in place on the abutment. Use finishing nails so that the nail heads can be countersunk. Place the beams in position and drill through the lower inside flange of the beam and the casting for the second nail. These nails will fasten the beams in place and, being on the inside, will not be noticed. The two nails in each casting will prevent turning of these parts.

The bridge deck is made up of two long guard timbers and the necessary ties. These are glued and pinned together, set aside to dry, and then stained. In the meantime, paint the abutments, I beams and pedestals. It is impossible to paint these after the deck is in place. Notice that there

are two thin planks that are placed on the top of the abutments and that the guard timbers of the deck are laid on top of these and fastened down. If care is taken to make these planks the correct thickness the deck ties will rest on the I beams.

Set the assembly in position on your pike and build the track foundation up to the abutments. The drawing suggests a good method of construction for this purpose. The thickness of the ties you are using on the right of way should be taken into consideration when determining the height of the foundation work on each side of the structure. After they are laid down, the top surfaces should line up with the ties on the deck.

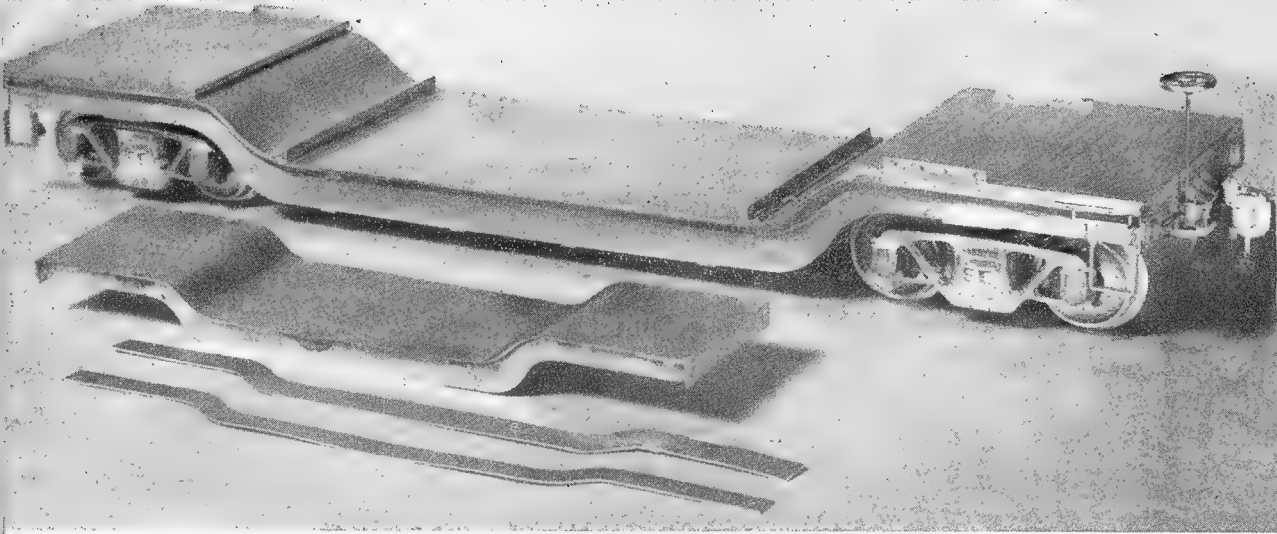
After the track is laid, two guard rails are cut, shaped, filed and spiked down. Bridge guard rails are installed on open deck bridges and trestles mainly for protection in case of a derailment. Generally, old rail is used for this purpose and is usually of a lighter section than the main rail and is laid about 8" to 10" inward from gauge. If the track is used in one direction only, the guard rails are laid with the curved ends pointing toward the oncoming traffic, as shown, and the opposite ends stop at the farther bridge abutment. If the track is used in both directions the guard rails should be pointed at both ends.

The culvert just described will take care of quite a torrent of water during the Spring months and it might be that the territory your railroad serves is more passive and therefore the installation of one of the pipe or concrete culverts would be sufficient for drainage. The "makings" of a concrete type are shown on page 111. After the parts are fastened together, a piece of cardboard, bristol board or like material is curved to fit the wood supports and nailed in place. In painting the wood to simulate concrete, plain gray can be used or, for better effect, paint the parts white, then streak and work in some black before the white sets. Concrete does not discolor evenly; in fact, it becomes quite streaked

and discolored after about five years, so try to model these discolorations for realism.

Pictures of the pipe types of culverts should offer enough latitude in character to allow you a choice in making one of these. The pipes can be sections of mailing tubes and the stones need no substitution—just use smaller stones. Glue will hold them in place. Add a little sand and colored sawdust and the picture is complete.

A few small pebbles and twigs should be glued in place after the painting of the scenery. Several varieties of weeds offer a means of duplicating trees, bushes and shrubs. These can also be bunched together to form clusters of bushes. Drill holes and glue the stems in them.



Completed but unpainted O gauge model and HO car under way.

TRANSFORMER CAR AND LOAD

How to Make an HO, OO or O Gauge Depressed Center Heavy Duty Car.

FREIGHT cars are like human faces . . . each one belongs to a certain type. Occasionally one sees a freight car that is an exception to the rule. The transformer car described in this chapter is an example of this. Very few of these cars are in service because extra large transformers, gears, etc., are not produced in quantity. For this

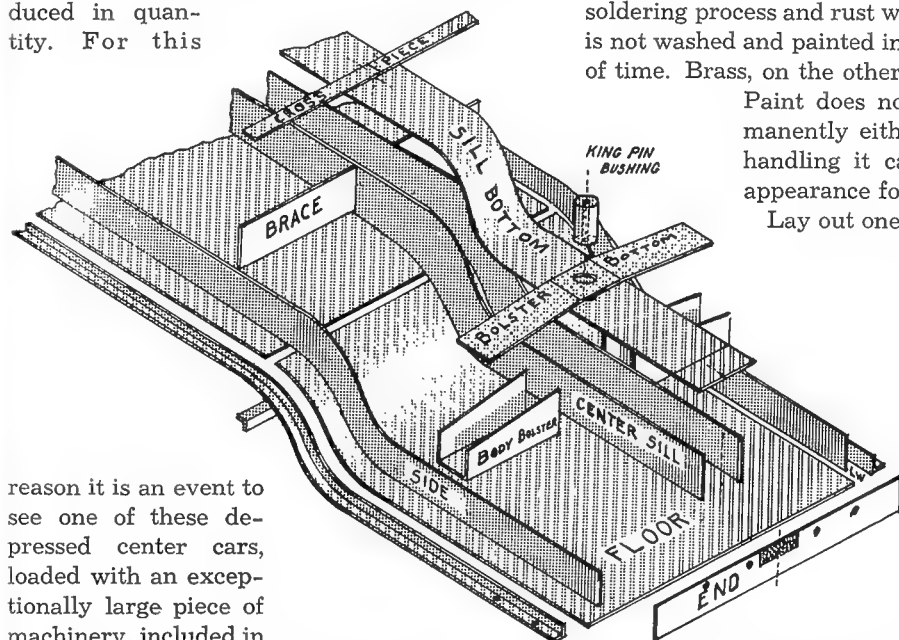
as sheet stock; all other materials vary in thickness depending upon the scale of the model, and recommendations will be made so that construction details in the three gauges will be clear to you. If shiny tin is used, remember that the material actually is sheet iron with a thin coating of tin. This coating is often eaten through in the soldering process and rust will set in if the model is not washed and painted in a reasonable length of time. Brass, on the other hand, will not rust.

Paint does not adhere to it permanently either, but with careful handling it can be kept in good appearance for a long time.

Lay out one of the sides on sheet

stock. Cut to the straight scribed lines with tin snips and to the curved lines with a half round file. Solder this to another piece of sheet stock and then file and cut the second piece to the contour of the shaped side.

Unsold the two pieces. Make two center sill sides by the same method. The left half of the elevation drawing is used when laying out the center sill sides. Notice that the $18\frac{1}{8}$ " measurement (full scale) is constant throughout the length of the center sill and that this does not hold true for the side pieces.



reason it is an event to see one of these depressed center cars, loaded with an exceptionally large piece of machinery, included in the makeup of a long drag. A car with this much personality whets the appetite for modeling it, so here goes.

The materials can be brass or shiny tin. The thickness should be about .012" for the body in O, OO, or HO. This material will be referred to

They taper to about 12" at the truck locations. Next, cut a plate 9 ft. wide and 16 ft. long from sheet stock. This plate will form the floor through the depressed section of the car. Before fastening these parts together, solder angle brass (O gauge, $\frac{1}{8}$ " x $\frac{1}{8}$ ", OO and HO, $\frac{1}{16}$ " x $\frac{1}{16}$ ") to the upper outside of the sides. Anneal the angle to ease the bending operations. Do the soldering from the top as this side of the angle will be covered with the floor plate. Fasten the side members to the plate just prepared. Making the floor of three pieces allows for some fitting at the reverse curve. These bends in the two remaining floor sections are formed over pipes of the right diameter. The pieces should be formed to fit snugly against the side members. While soldering the floor sections to the sides, do this from the inside. Cut two pieces from sheet stock for the ends of the car and solder in place. The end plates extend out full width of the car as shown.

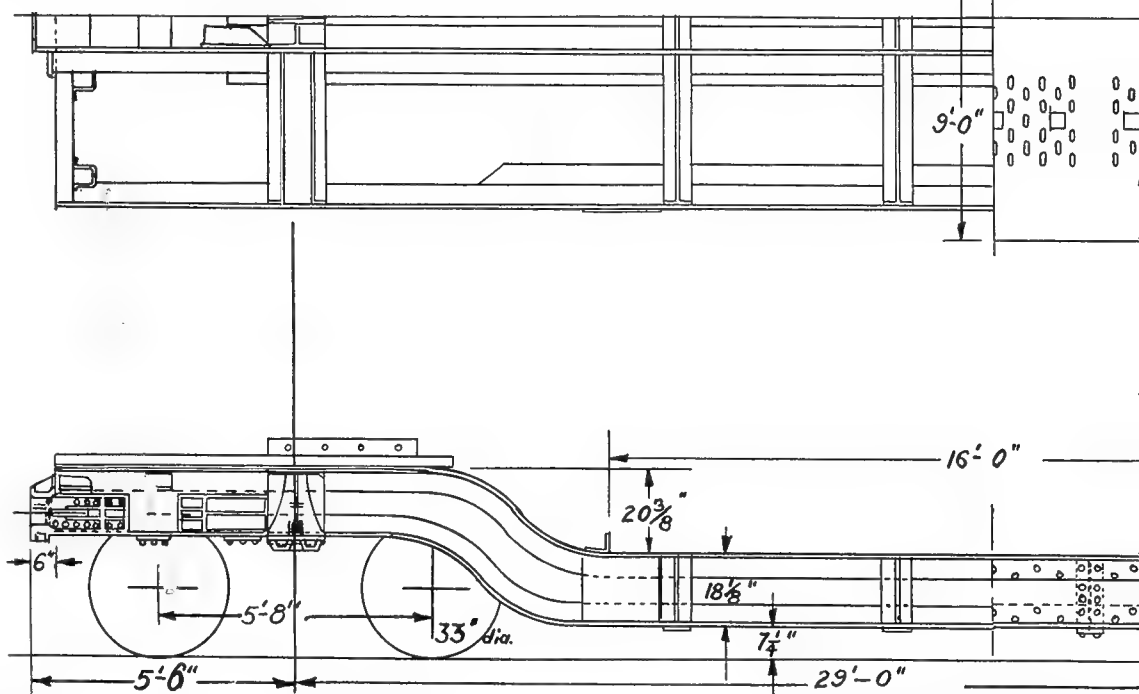
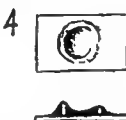
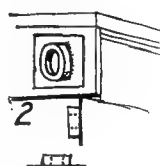
Cut the sill bottom from sheet stock and bend it to shape. A wood spacer block is used when soldering the sill bottom to the sill side pieces and a wood block is used underneath as a backer up. Before soldering this unit to the bottom of the car, a method of mounting the coupler should be figured out. To begin with, the center of the coupler must be a certain distance up from the top of the rails. This is $\frac{3}{4}$ " for O gauge; 11.5 mm. for OO and 10 mm. for HO. Referring to the elevation, it is seen that the top of the metal floor is 3'-9 $\frac{3}{4}$ " above the rail head, which means that a metal pad will correct the difference. The per-

spective shows the pad or shank block soldered in place and the end sill notched down to the pad. The thickness of the shank block can be checked for usefulness by putting the center sill in place on the body and setting the assembly on a pair of trucks.

Locate the positions of the body bolsters, cross pieces, bolster bottoms and braces. Scribe lines on the body from one side to the other to facilitate the mounting of the various parts in correct position. The parts are fabricated from sheet stock and all are prepared before doing any of the soldering. The body bolsters can be made from solid stock or bent in the form of channels.

Drill two holes for the truck kingpin bushings in the body bolsters. As shown, the bushings are simple turnings. Solder them in place and tap the holes for the king pins. Locate the positions of the holes for grab irons and drill.

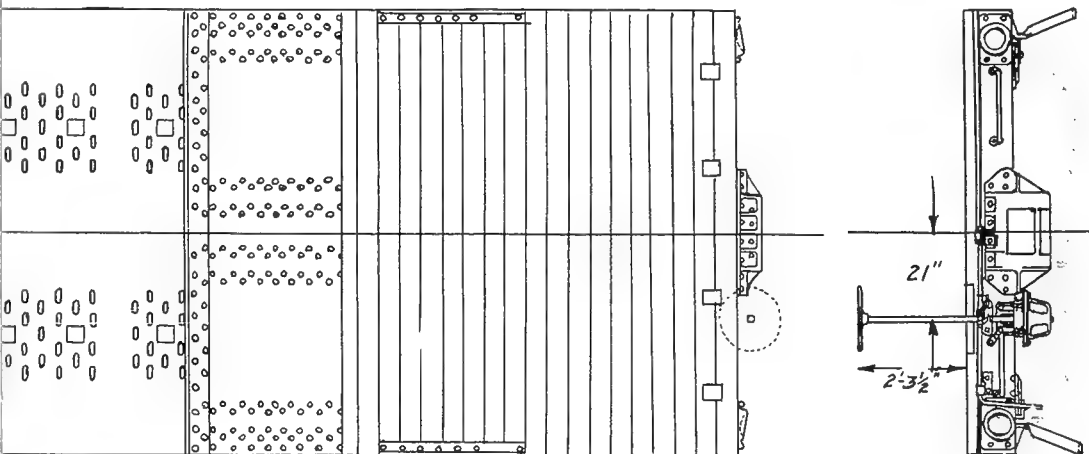
Three pieces of metal are used in producing the coupler pocket. No. 5 is made from sheet brass to the contour of the plate shown in the end elevation. A deviation in the size of the coupler opening is made



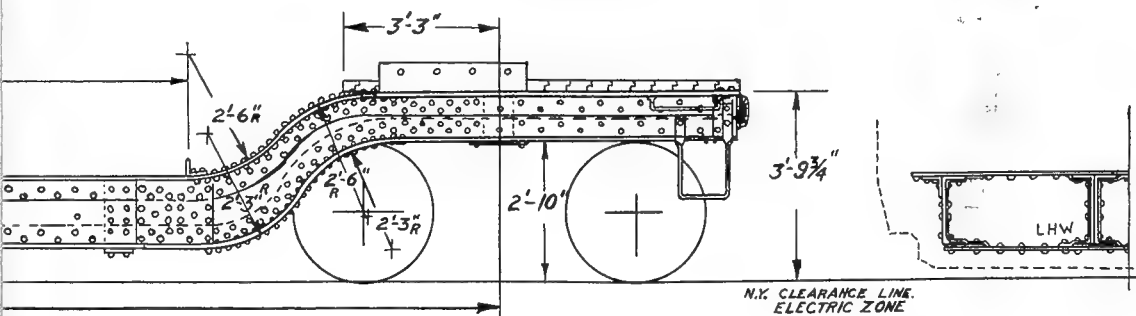
to permit the coupler shank to swing from side to side. After duplicating the part (as outlined for making the sides), solder both in position to the end sills. The stock used for No. 6 varies in thickness for the different gauges. Use $\frac{1}{8}$ " stock for O gauge and $\frac{1}{16}$ " for OO or HO. Lay out the part on the end of a piece of brass and file to shape on all sides except the one being held in the vise. Cut this side off last and file. The opening in this piece for the coupler should be the same as in No. 5. A scrap piece of brass is used for No. 7. Adding this piece to the bottom obviates the necessity of filing a hole in No. 6 as would be the case if Nos. 6 and 7 were made as one piece. Soldering 5, 6, and 7 in place can be done neatly

if the parts are held in place with a small battery clamp and the solder is made to flow from one edge to all of the contacting surfaces.

The poling pockets are made up of sheet stock



PROTOTYPE PLAN—Milwaukee Road transformer car, construction of which is described for O, HO, or OO gauge. This plan is to $\frac{1}{4}$ " scale and any dimensions not given can be taken off with any ruler. The original cars are numbered 67025 and 67027.



and tubing. Cut four oblong pieces (shown in end elevation and small sketches 2, 3 and 4) and solder them to the end sills in the positions shown. The diameter of the tubing varies, $\frac{3}{16}$ " o. d. and $\frac{1}{8}$ " i. d. for O gauge, $\frac{3}{32}$ " o. d. and $\frac{1}{16}$ " i. d. for OO and HO gauges. Cut

off four pieces and solder them in position. See sketch 2. Then bevel them off with a file as shown in sketch 3 and top plan. Sketch 4 shows how the solder is formed around the pocket. A small round file is used to finish the pockets to shape.

Four sill steps (No. 8 on this page) are bent to shape and the ends twisted. These are made from

$\frac{1}{64}$ " x $\frac{1}{16}$ " brass for the O gauge model and $\frac{1}{64}$ " x $\frac{1}{32}$ " for the smaller gauges. A piece of wood or brass the right size makes a splendid forming tool for the steps, each one being exactly the same width. Twist the ends by using two pairs of pliers. After these are soldered in place, bend up the grab irons, push the ends through the holes previously drilled, and solder in position.

The upper decks of the car are planked for loading. The plank thickness is $\frac{3}{32}$ ", which is $\frac{1}{16}$ " in O gauge and about $\frac{1}{32}$ " in OO and HO. Cut a piece of brass for each deck and scribe lines on the metal to simulate the planking. File a notch on each side of each platform to take the angles shown in the pictures and drawings. Solder the decks in place and clean off with a file. Four plates made of sheet stock are fitted in the notches in the decks and soldered in place. Drill four holes in each plate as shown.

To fasten the coupler, drill a hole through the sill bottom, the shank block and the coupler shank. Tap these holes (including the one in the coupler shank) 2-56 for the O gauge version and run in the machine screws to hold the couplers in place. Taps for these screws are available at your hobby shop.

Solder an angle to the floor directly over the joint made between the floor sections. The distance between the two angles should be 16'-0". See the side elevations. Two brackets are filed to the shape shown in the perspective sketches (9 and 10) and are used to support the brake shaft. Solder them to the end sill before drilling

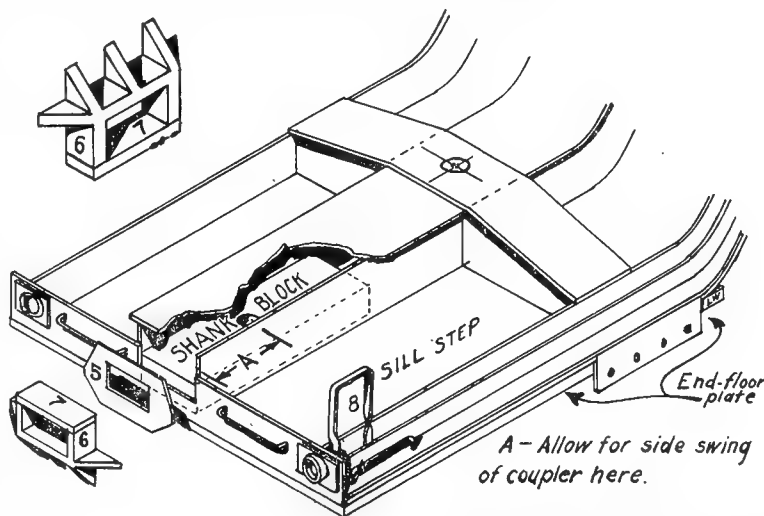
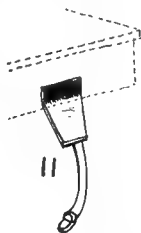
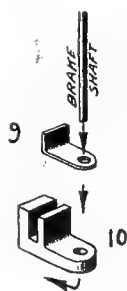
for the shaft. Music wire is sold by model airplane supply houses in several diameters and 2 ft. long. A piece of this, cut to length, is soldered in place to the brackets after being bent over at the bottom. Solder a brake wheel to the other end of the shaft.

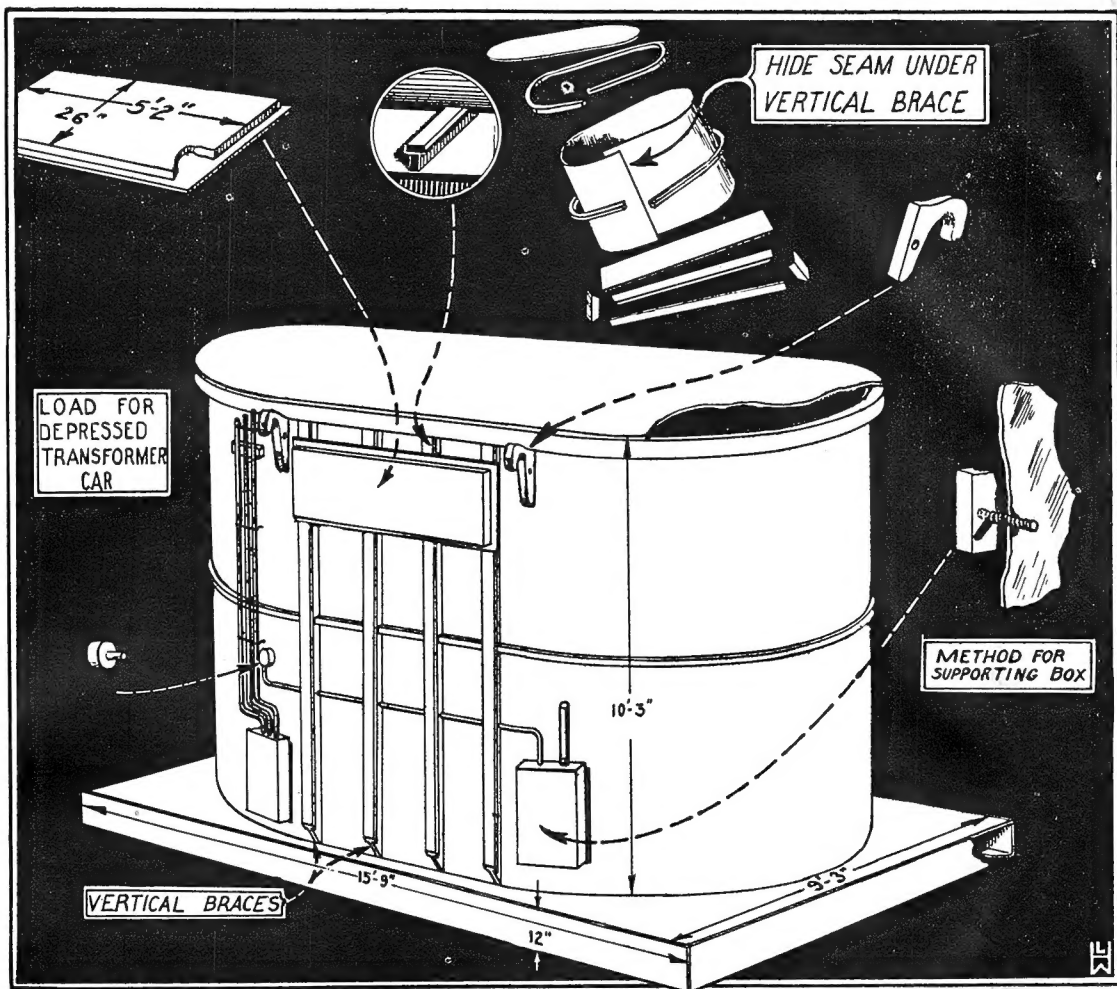
Although the prototype is equipped with Andrews trucks, it will be necessary to use the Bettendorf type on the smaller models. A good Andrews truck would be welcomed by the OO and HO fans. Due to the all-metal construction of the car, it is advisable to insulate the trucks from the body if two-rail operation is used. This is done by insulating the king pin either from the truck or from the body.

Mount the air hoses as shown. A small bracket is cut from sheet stock and soldered to the end sill. The air brake hose is heavy brass wire soldered to the bracket. Form a blob of solder to the loose end of the air brake hose to represent the coupling, or "glad hand," as the railroad men call it. File away about one-half of the blob to form the "palm" of the "glad hand."

The transformer pictured on page 117 is shipped on this type of car to allow for clearances and, because of its size, shape, etc., makes an ideal load to model. The heavy bracing beams and guy rods help to add that something that puts the wallop in modelmaking.

Sheet stock (.012" thick half hard brass or shiny tin) is used in fabricating all of the parts except when specified otherwise. For example, the beams used for bracing the load will be of a different size for O, OO and HO, but .012" sheet stock is flexible and strong enough to form the body, etc., for all of the gauges.





The dimensions are full size and are scaled down to the proportion you are interested in by using a conversion rule or chart.

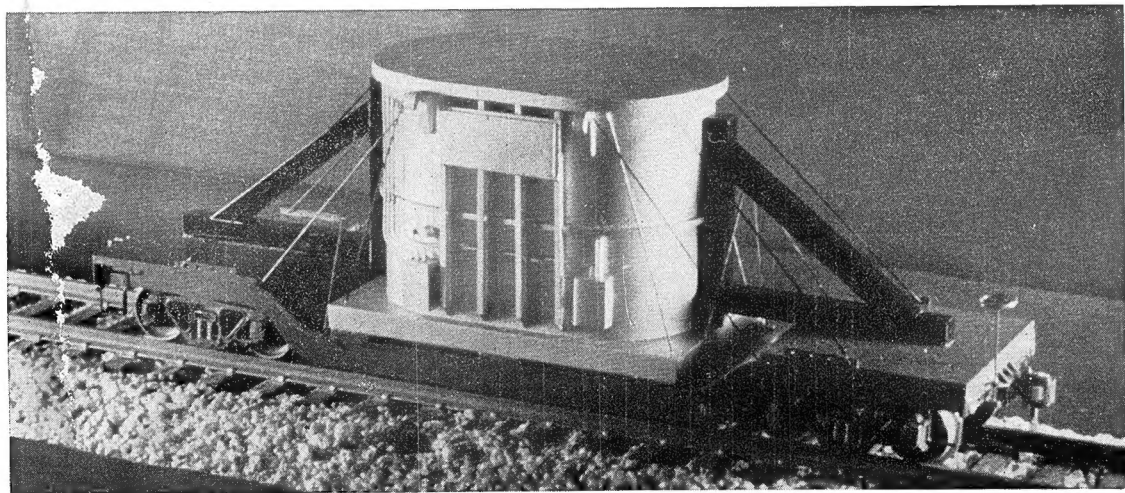
Cut a piece of sheet stock to the size of the base, 9'-3" x 15'-9". On this sheet, lay out the oval line to locate the side of the transformer. To do this, scribe half circles toward each end of the plate and connect them with straight lines. The half circles and the straight lines should be laid out 6" from the edges of the base. Scale down the height of the transformer side sheet (10'-3") and cut a piece of sheet stock to this width and long enough, plus 1/2" for overlapping, to compare with the length of the scribed oval on the base sheet. Notice that the height of the transformer is immediately referred to as the width of the sheet. This is because there is a grain to the sheet and it is good practice to do the bending across the grain if a smooth, unbroken curve is to be developed.

As in the case with almost all bending jobs, try bending the transformer side sheet over a pipe (plumbing) or rod until the proper shape is ob-

tained. This is a try and try-again procedure due to the inherent springiness of the material. The ends are overlapped as shown, and soldered together from the inside. Set the assembly on the base sheet, lining up the formed piece with the scribed line on the base, and solder together.

Bend four angle pieces from sheet stock to form the sides, ends and bottom of the base and solder in place as shown in the photos and drawing. The angles can be bent by clamping the material between two pieces of, say, 1/4" square rod and bending the surplus over the edge of the square stock. This method is especially useful if the length of the angle exceeds the width of the vise jaws. Be sure to use a wood block as long as the part to be bent as a buffer between the hammer and the material. This will prevent unwanted distortion and contribute immensely toward a clean-cut model.

The collar fastened around the midriff of the body is approximately 3" square. For the O gauge model, use 1/16" square brass (third rail material); OO and HO models will look best if



$\frac{1}{32}$ " square brass is utilized. This section is often used for third rail in the two smaller gauges. Order a small stock of each of these materials, as they are useful in the building of models. Getting back to the work at hand, bend a piece of square stock around the body of the transformer, then slip it off and bend it around a pipe of smaller diameter to compensate for the spring-back. Do not solder the part in place unless it lies naturally against the body. Bend the piece properly rather than expect the solder to hold it in place.

Make the upper flange in the same manner as described for making the collar. The materials used are heavier, $\frac{1}{8}$ " square being used for O gauge and $\frac{1}{16}$ " square for OO and HO. Solder this piece flush with the top of the side, and, incidentally, do the soldering from the top to save cleaning off excess solder.

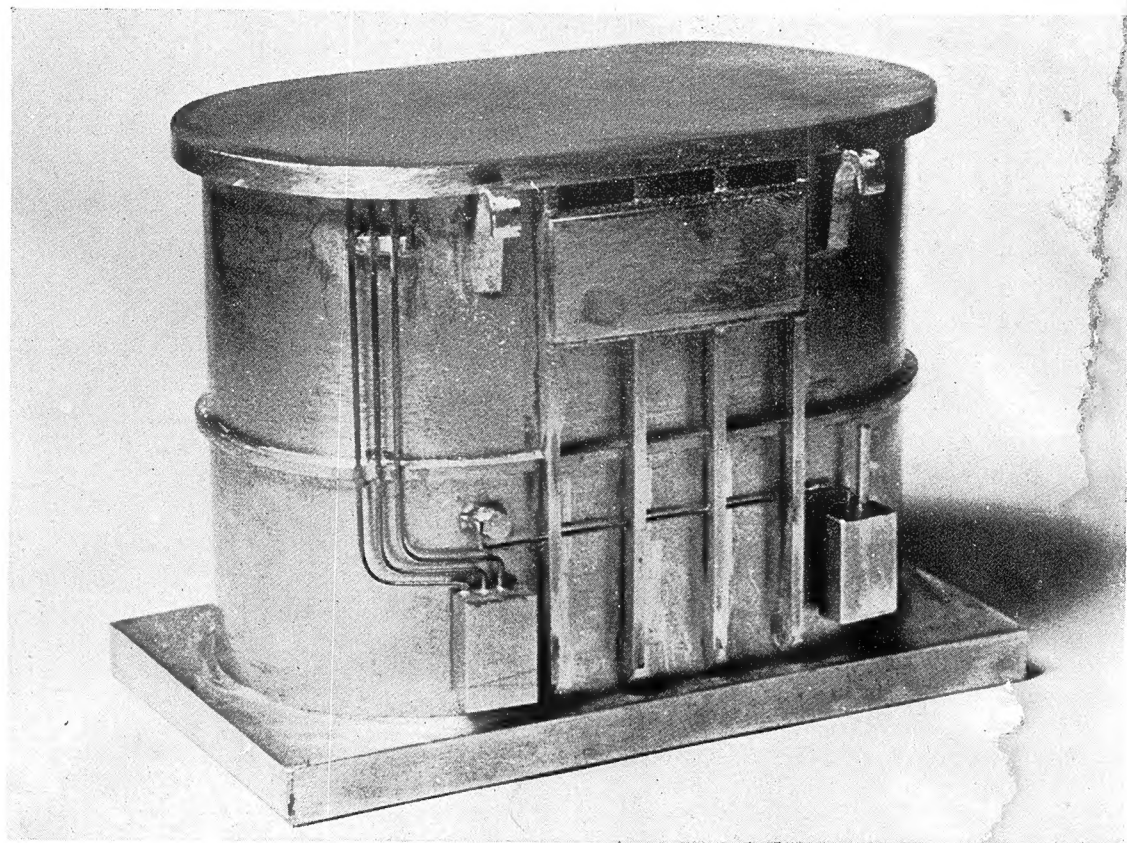
Four I beams are fastened to the body as shown. Actually these are 6" deep with a flange 3" wide. For the O gauge model solder $\frac{1}{8}$ " strips, cut from sheet stock, to $\frac{1}{16}$ " strips of the same material, forming the letter T. Divide the dimensions in two for the smaller models. File a notch in each of the four beams to coincide with the collar and then allow the beams to rest snugly against the body. Space the outer beams 5'-9" apart and the inner ones equidistant apart. Solder in place, using a hot iron sparingly so as to avoid unsoldering the T section. File the bottom of the braces on an angle. See the photos. The plate (shown in the drawing) is made up of two parts and is soldered to the upper portion of the I beams. The part soldered directly to the beams is cut from sheet stock and, in the case of the O gauge model, a $\frac{1}{8}$ " plate fashioned to the size shown is soldered to it. The last named plate is made from sheet stock for the smaller models. Scale down from the dimensions shown.

The four massive hooks fastened to the upper

sides of the body are used by cranimen when the transformer is to be moved. For O gauge, use brass $\frac{1}{8}$ " thick; half this will do for the smaller models. Compare the shape of the hook with the outline you have drawn and make the necessary changes. Also notice that the hooks are just about as long as the width of the plate between them, only the hooks are placed higher. Solder the hooks to the body and clean off excess solder.

There are two terminal boxes for the wiring connections; these are placed on each side of the four braces. The boxes measure 6" x 14" x 18" and are modeled solid from a piece of brass. Drill a No. 50 hole in the center of each box, halfway through the metal, and tap 2-56. Run a long machine screw into this hole and then snip the head off. File off any burs, etc. Locate the boxes in the proper places and drill No. 50 holes in the transformer body at the points where the screws come. Tap these holes in the body. Drill holes in the top of the boxes for the pipes before twisting the boxes in place. A hole must be drilled through each of the four beams for the conduit (wire) and the best way to handle the problem is to drill through two beams from one side and then drill through the other two from the other side. Lay out the holes carefully to insure hole alinement. The drawing shows a round button with a small shaft protruding from the rear. Make this up and drill a hole for the shaft in the body of the transformer just above the left terminal box. Press the shaft through the hole, allowing some room between the unit and the body, and solder to the inside. The same applies to the terminal boxes. See the drawing.

Although music wire is tough on cutting pliers, it is a good medium to use in piping the transformer and for the stay rods because it is straight to begin with and it will keep its shape better than brass wire if handled quite a bit.



To make the cover of the transformer, place the assembly upside down on a piece of sheet brass and scribe around it; then cut the sheet to the scribed outline with tin snips. File off any solder that causes imperfect contact between the cover and the body, then solder the cover in place. Trim flush with a file.

Six shims or pieces of blocking are placed between the transformer and the car. See photos. These are actually about 3" x 6" x 12" and are made of brass for the model.

Solder the lead to the car at the location of the six blocks. Then select a drill that will make a hole slightly larger than the diameter of the wire to be used and drill holes at the various locations, best seen in the photo of the finished model. Notice that a hole is drilled through each of the hooks for this purpose.

Obviously, it is best to make up the timber bracing and put it in place before any wires are installed. These beams are actually 12" square, so use $\frac{1}{4}$ " sq. for O gauge and $\frac{1}{8}$ " sq. for OO and HO. It is practical to simply solder or screw the parts together if metal is used to simulate the timbers. After the job is painted no one will know the difference. Wood can be used but it will not withstand the punishment that metal will. The metal timbers are assembled on the

bench and then fitted in position and soldered to the car and to the transformer. Next, install the stay rods. Keep these as straight as possible.

It is realized that there exists a group of modelers who would prefer to mount the transformer so as to allow it to be taken off without much trouble. To do this, allocate one or two pins and a machine screw to the bottom of the transformer. Holes to jibe with these should be drilled in the platform of the car so that when the pins are led through the holes the transformer will spot in the same place each time the operation is repeated. With the unit in place, a rod can be run on the machine screw protruding through the bottom to keep it there. The rod and bracing can be soldered permanently to the transformer. The loose ends of the rods are fed through holes provided in the car.

There is one operation that remains to be reckoned with and that is the painting. Prepare the model by giving it a bath in a strong cleaning solution, as oil, flux and finger marks are hard to cover with paint. Remove the trucks and couplers before starting the job. The car, couplers and trucks are painted box car red, and the transformer either gray, aluminum, or black. Black is not recommended because of drabness; use gray or aluminum for contrast.

